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# VOYENNO-MEDITSINSKIY ZHURNAL

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PROPOSED INNOVATIONS



REVIEWS



CHRONICLE

## Toward Further Improvement in Technical Equipment of the Military Medical Service

The Twentieth Congress of the Communist Party of the Soviet Union adopted a plan of development of the national economy for 1959-1965 which is the most important part of the program for creating the technical basis of Communism. The Party is posing the problem of the future development and perfection of heavy industry, the future development of high rates of electrification of the national economy, of continuous scientific-technical progress in all branches of industry and agriculture, of the extensive adoption of new technical equipment, comprehensive mechanization and automation of all industrial processes.

The Seven-Year Plan has been thoroughly infused with a real Leninist concern for the welfare and happiness of the Soviet people -- the builders of a bright future of a Communist society. One of the expressions of this concern is the further improvement in the protection of the health and medical care of the population. Along with the increase in the capital investments in the construction of public health institutions, for social security, physical culture and athletics, the medical industry will obtain considerable development also, particularly the production of antibiotics and other medicinals.

In the control figures for the development of the national economy of the USSR for 1959-1965 provision has been made for the further increase in production of medical equipment. At the end of the Seven-Year Period the output of medical instruments, devices and apparatuses will increase by two to two and a half times. The nomenclature of manufactured products will be extended. In the specialized plants of the medical instrument industry alone the number of manufactured articles will increase to 2100 in 1965 as against 1700 put out in 1958. The assortment of medical articles will be increased considerably because of the output of new and the modernization of existing articles of medical equipment. All this will permit Soviet public health to improve the medical care of the population still further.

The military medical service is confronted with a great and responsible problem in the matter of maintaining the health of the service men.

Work on the maintenance of the health of the soldiers of the Soviet Armed Forces is being supplemented materially by the military medical service equipment which the Country is giving it on a large scale and generously. A high level of medical care of the Army and Navy personnel is unthinkable without the proper technical equipment of the medical service.

The specific working conditions of military physicians under the complex operational circumstances of the troops make them work, at times, under a maximum load and give rise to the need for a constant perfection of the technical equipment which will facilitate the work and make it more productive. In developing new types of military medical technical equipment special attention should be given to its use for improvement of therapeutic-prophylactic, sanitary-hygienic and antiepidemic care, for the better, more perfect treatment of patients, and during battle operations, of the wounded. Everything should be subordinate to the principal idea -- the more rapid making of diagnosis of disease, the rendering of the necessary aid and performing the necessary operative procedures, all with work of high quality.

Exceptional perspectives are being uncovered for making the work process of physicians, particularly military physicians, more efficient in connection with the vigorous development of science and technics in the forthcoming seven-year period. The achievements of radioelectronics, chemistry, instrument construction and other branches of industry are being brought to the service of medicine on a progressively greater scale. The use of radioelectronics in the medical installations will, to a considerable degree, increase the objectiveness, speed and accuracy of making a diagnosis and will make it possible to prescribe timely necessary therapeutic-prophylactic measures. Even now, radioelectronic apparatus is finding considerable application for the diagnosis and therapy of many diseases. Various electrocardiographs and vectorelectrocardioscopes have been created for the recording of the electric impulses of the heart, a phonograph for graphic recording of the sounds of the working heart, a pulsotachometer for the continuous measurement of the pulse frequency, the electroencephalograph for the investigation of the electrical activity of the brain, an electrogastrograph for recording the varying action potentials of the peristaltic activity of the stomach, an apparatus for counting red blood cells, white blood cells, etc.

The use of electronic computers in medicine is opening up broad possibilities in the matter of solving the most varied problems. It may be said without error that the use of electronic computers will be very effective in the diagnosis of various diseases, in medical statistics, planning of medical supply, etc.

The large number of complex diagnostic devices which have appeared in recent years poses the problem of mechanization and automation of the very process of making a diag-

nosis, that is, an analysis of the data obtained from recording apparatuses, laboratory examinations, and the generalization of these data as well as working out a result. The expediency of utilization of electronic equipment in surgery and other branches of medicine is indubitable.

The further development of agents and methods of physiotherapy is directly related to the achievements in radioelectronics and other branches of physics.

Great possibilities are inherent in the use of ultrasound in medicine. Ultrasonic diagnostic apparatuses should occupy an important place in the determination of foreign bodies, tumors, kidney stones and bladder stones in the body.

For purposes of reducing the time needed for X-ray diagnosis further improvement of the methods of roentgenological examination is needed. In this respect, the use of radioactive isotopes, image translators, and the xerographic method are of interest.

Further "mechanization" and "automation" of the most complex and laborious medical procedures are assuming tremendous importance. Various apparatuses have already been created for suturing tissues and organs by means of metal clamps, the electrodermatome, electric aspirator, electric plaster-cutters, devices for artificial respiration and many other semiautomatic devices, apparatuses and instruments. The mechanization of work in the care of patients is playing more than a small part -- the incorporation into practice of hoists for seriously ill patients, various rollers, functional beds with rotating mechanisms, machines for washing bed-pans, etc. In the next few years, it will be necessary to create equipment which completely mechanizes this work.

The progress made by chemistry in recent years has enriched the arsenal of measures for the prophylaxis and treatment of many diseases. Progressively greater attention is being given to alloplasty in recent years -- the replacement of tissues by material taken from outside of the patient's body. The use of plastics as alloplastic material is making it possible to eliminate the harmful chemical effect of implants on the tissue and, to a considerable degree, to limit their mechanical effect. The creation of blood-vessel prostheses, prostheses for the esophagus and biliary passages from elastic plastics, the use of capron tissues and nets for the replacement of large defects in the abdominal wall aponeuroses, etc., have opened up new possibilities for restorative surgery.

Various synthetic fibers are being applied extensively for surgical operations. Capron and nylon threads, which

possess considerable strength and are slowly absorbed, are being used for suturing aponeuroses and fascia, muscles and skin, as well as for the ligation of blood vessels. Fibers which undergo absorption in the body also have a great future. New surgical instruments have been developed on the basis of the use of plastic -- syringes for injections, syringe tubes, various sounds, and such very complex apparatus as "the artificial heart-lung" and the "artificial kidney."

The problem of utilization of biological and synthetic adhesives for gluing together various tissues of the body instead of suture as well as for the gluing together of long bones, replacement of bone defects, and restoration of movement in joints is not without interest to military surgeons.

Based on the latest achievements in chemistry, physicians should not only creatively utilize the synthetics produced by the chemical industry but should also work out scientifically sound requirements for the creation of new material and products from them which are needed for improving the equipment of medical installations. These achievements of industry should be kept in mind in developing certain articles of field equipment, vessels, immobilization facilities, etc.

For example, research in the field of utilizing rapid-hardening plastic is expedient for the preparation of various transport splints. There is now a need for replacing heavy, breakable glass vessels, blood transfusion systems, articles of toilet care of patients and other equipment by plastic products better suited to these purposes.

The use of synthetic blood-substitutes of the dextran-polyglucin, polyvinylpyrrolidone type, etc., is assuming exceptionally great importance for therapeutic and prophylactic purposes.

Equipping the military medical service with modern medical evacuation facilities is of tremendous importance. The ambulances UAZ-450A, AS-3, PAZ-651s, and ZIL-158s which have been adopted on the supply of the military medical service in recent years answer their purposes. However, the developmental perspectives for automotive transportation in the forthcoming seven-year period make it possible to create ambulances which possess an even greater roadability and give greater smoothness in the ride.

The proper solution of problems of technical equipment of the military medical service is possible only through the high degree of creative activity of workers in the scientific research institutes, the Military Medical Order of Lenin Academy imeni S. M. Kirov, the technical committee of the Main Military Medical Administration and military physicians

generally. The complete development of efficiency and inventive work of military physicians will contribute to the earliest solution of the problems posed.

The achievements of various scientific research institutions and design offices, particularly of the scientific research institutes of the union and republic ministries of health, should be used on a broader scale. For this, the chiefs of the military medical departments of the districts and fleets should maintain an even closer connection with the scientific research institutes, and should keep abreast of the thematics being developed by them. The extensive incorporation of scientific and technical achievements into medical practice makes it possible to take progressively more varied and complex technical equipment, apparatuses and new effective therapeutic agents on the s supply of the medical service. Medical service workers should study carefully and efficiently and carefully utilize the technical equipment taken on supply, and be economical in the expenditure of medical equipment. The military medical service personnel should gain a complete understanding of the significance of economy of equipment and skillful care of it.

Problems of medical equipment are indisruptible from the concept of medical care of battle operations of the troops. They are indisruptibly connected also with the everyday concern for the improvement of therapeutic-prophylactic work among the troops. Therefore, the work in creating new medical equipment should be carried out for purposes of assuring the entire total of prophylactic and therapeutic measures directed at maintenance of the health of the service men, the prevention and reduction in the morbidity rate and loss of work, the timely recognition of disease and improvement in the treatment of patients.

The development of such equipment should be based on the latest achievements in medical science as well as on the achievements of various branches of science and technics, before which broad possibilities have opened up because of the constant attention of the Communist Party and Soviet Government.

# Military Medical Terminology

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Docent L. S. Yevlanov, Colonel of the Medical Service

The problem of military medical terminology has been raised repeatedly on the pages of the military medical press. This is completely understandable, because the vigorous development of all branches of science in the Soviet Union, including that of military medicine, has required a revision of the definitions of certain old terms and the introduction of new ones.

Nevertheless, it cannot be considered that all the problems of military medical terminology have been solved. Too often, the most varied terms are being used in military medical literature and in the practical activity of medical workers for designating the same concepts. Naturally, the lack of a standard terminology does not contribute to the exact understanding of various phenomena or to the elaboration of unanimous views on the principles and forms of medical care of the troops under modern conditions. Therefore, the development of correct terms and their standardization is one of the urgent tasks of the medical service of the Soviet Army at the present time.

In connection with this, it seems expedient to us to raise the question once again of military medical terminology in order to attract the attention of the military medical public to it and contribute to the very quick resolution of it. First of all, let us discuss certain general requirements which are made of terms.

The main requirement made of terms is the accurate definition of concepts by them, which, in their turn, constitute our logical idea of the objective world. Thus, for example, the term "wounded" accurately defines our concept of a man who has an open injury of the integument (wound); substitution of this term by another would not correspond to our concept of the given phenomenon.

An important requirement in the matter of terms is simplicity and understandability of them. V. I. Lenin pointed out that writing for the masses should be accomplished without terms which require special explanation. Undoubtedly, the use of complex terms complicates the understanding and remembering of them and can lead to different interpretations of the same concept.

Finally, in working on the perfection of terminology it is essential to take into consideration the terms which have been built up historically, even if they no longer

accurately reflect our concepts about various phenomena. In this respect, mention may be made, as a graphic example, of the maintenance of the term devised in the past, "horsepower," even though its application to the designation of the power of various machines is of a purely arbitrary nature.

Let us examine certain problems of military medical terminology which pertain primarily to the organization of the medical service and which, in our opinion, are the most important.

It should be emphasized that the data which we are presenting represent more than just the viewpoint of the authors. At the end of the past war, the Main Military Medical Administration approached a number of installations, including the Military Medical Order of Lenin Academy imeni S. M. Kirov, with the suggestion that they give their consideration to certain terms. A number of the chairs of the Academy presented their material on this problem, which was then generalized by a special board. The chair of medical service organization and tactics presented its views on the organizational problems, and they were entirely approved by the board.

First of all, terms to be used for designating the concept "sanitarnyye poteri" [casualties; literally, medical losses] require standardization. In definitions of "sanitarnyye poteri" in the Soviet literature the terms "wounded and sick," "wounded, battle-afflicted and sick," "wounded, afflicted [a general term which can be used for gas, radiation, neuropsychiatric casualties, etc.], burned and sick," and others are encountered. There are many inaccuracies in all these terms, since they do not completely characterize the phenomena defined in the concept "sanitarnyye poteri." Thus, designating "sanitarnyye poteri" by the terms "wounded and sick" would be inaccurate, because under modern conditions there would be not only wounded (in the medical interpretation of this word) but also other categories -- burned, affected by ionizing radiation, war gases, toxins, etc., among those suffering from the enemy's weapons. The term "wounded, afflicted and sick" which has become widespread for designating all the "sanitarnyye poteri" is also inaccurate, because, first of all, the wounded are also afflicted, and, secondly, among the casualties designated by the term "afflicted" (if we have in mind those afflicted by mass attack weapons) there are also wounded (for example, a secondary wounding shell fragment from an atomic explosion). (References to the fact that the term "porazhenyye" [afflicted] can be understood as a derivative of the military term "porazheniye" [defeat] do not have a very sound basis,

because we do not say "porazhennaya chast'" [defeated unit], "porazhenyye voyska" [defeated troops] (in the military sense0, but rather, conversely: "chast', poterpevshaya porazheniye" [a unit which has suffered a defeat], "voyska, poterpevshiye porazheniye" [troops which have suffered a defeat]. There are no grounds at all for such an interpretation of the term "porazhenyye" as applied to patients.)

We believe that the best terms for defining "sanitarnyye poteri" are "porazhenyye i bol'nyye" [afflicted and sick]. Thereby, by "porazhenyye" is meant all those affected by the enemy weapons who have clinical signs of "porazhenie" [affliction] and who have lost their fighting capacity (or working capacity) for a period of no less than 24 hours on account of their health. The addition of the words "in battle" to the term "porazhennyy" [afflicted] narrows the concept defined by this term, because it connects the service man's affliction only with participation in battle. Nevertheless, "porazheniya" [afflictions] of troop personnel may be produced outside of battle also (for example, when the unit is on furlough). Among the afflicted there are also those who have been frost-bitten.

All those persons should be considered "sick" who have lost their fighting capacity (or working capacity) for a period of no less than 24 hours, whose health impairment was not brought about by the direct effect of enemy weapons. Undoubtedly, the weapons will, to some degree, influence the morbidity rate of the troops. It is known, for example, that in persons who have been exposed to the effect of penetrating radiation in the past the susceptibility to various kinds of diseases is increased. Therefore, the absence of any direct effect of enemy weapons is emphasized.

Depending on the nature of the affliction (or disease), the afflicted and the sick casualties are divided into categories. Among the afflicted the following categories should be distinguished: wounded, afflicted with local closed trauma, burned, those afflicted by war gases, those afflicted by ionizing radiation, and those afflicted by bacterial weapons. The sick are divided into categories in accordance with the accepted classification of diseases -- those sick with diseases of the circulatory organs, repiratory organs, gastrointestinal tract, etc.

The problem of terms to be used for the definition of the afflicted who have been afflicted by various types of weapons and various afflicting factors of the same weapon is directly related to what has been stated. It appears that the entire variety of afflictions produced by various types of weapons or various afflicting factors of the same weapons can be divided into three groups: combined afflictions,

multiple, and associated afflictions. Thereby, all the persons afflicted who have sustained injuries from several types of enemy weapons or several afflicting factors of the same weapons (for example, gunshot wound and war gas affliction, burn and penetrating radiation affliction, etc.) should be classified in the group of combined afflictions.

In the group of persons with multiple afflictions (wounds, burns) are the afflicted who have injuries of various organs or systems from the same afflicting factor of the given type of weapon (for example, gunshot wound of the skull and thigh, affliction of the face and exposed parts of the hands with persistent war gases of the mustard gas type, etc.). By associated afflictions is meant the affliction of adjacent organs or systems produced by the same afflicting factor, for example, a wound of the skull and eye by the same bullet or same shell fragment, affliction of the eye and adjacent skin of the face by a persistent war gas, etc.

With the use of modern types of weapons persons may be afflicted also who at the time show no signs of a disturbance in health, but with respect to whom various prophylactic measures or medical supervision needs to be carried out. Therefore, from the point of view of the organization of the principal measures for the elimination of sequelae under these conditions it is expedient to divide all the patients into two groups: contaminated and afflicted. By "contaminated" is meant persons who have been in a region (or in a territory) exposed to the effect of radioactive agents, chemical or bacteriological weapons, in whom there are no clinical signs at the time but with respect to whom various prophylactic measures are expediently carried out (for example, sanitary processing) or over whom medical supervision should be established. In contrast to this, as has been mentioned, persons with definite signs of affliction and who have lost their fighting capacity for a period of no less than 24 hours should be included in the group of the afflicted.

In connection with such a classification of those suffering from the modern types of weapons it is expedient to distinguish foci of mass attack and foci of contamination. By a "focus of mass attack" is meant a territory with the persons, animals, battle technical equipment, transportation and other equipment on it which has been exposed to the effect of attack weapons which are capable of producing affliction of persons quickly and directly (for example, an atomic weapon with a blast effect, highly toxic war gases, toxins, etc.). By "focus of contamination" is meant a

maintained, which is expediently used in cases where only a specific matter in the system of measures is meant rather than the entire system of measures in a certain field of medical service activity. For example, the term "lechebno-evakuatsionnyye meropriyatiya" [therapeutic-evacuation measures] well characterizes one of the aspects of medical service activity in eliminating the consequences of attack against the troops with new types of weapons.

For a number of years the term "punkty sbora porazhennykh" [collecting posts for the afflicted] has been used very extensively on the pages of the periodical military medical press. Here, by "punkty sbora porazhennykh" is meant the medical aid stations of the small and large troop units and various groups of medical service personnel participating in the admission and classification of the afflicted persons coming from foci of large-scale casualties and in giving them medical aid. Introduction of the term "punkt sbora porazhennykh" [collecting post for the afflicted] has led to the fact that the medical aid station (or installation) has changed its name in a comparatively short period of time. Such a situation is unnatural, particularly since the number of afflicted persons admitted cannot be established simply for the purpose of determining the time at which a medical aid station (or field hospital) changes its name to a "collecting post for the afflicted."

The attempt to give a sound basis to the competency of the term "punkt sbora porazhennykh" in the fact that under conditions where the afflicted are admitted on a massive scale the newly activated medical service units (medical aid station, medical battalion, field mobile surgical hospital) with their different problems and staff organizations carry out the same function is incorrect, because even under these conditions there is a certain difference in the volume of medical care given at the regimental medical aid station, on the one hand, and at the division medical aid station and the front line field mobile surgical hospital, on the other. There is also a difference in the number of afflicted which may be accepted by the regimental medical aid station, division medical aid station and field mobile surgical hospital participating in the measures for eliminating the consequences of the attack.

The nature of modern battle assumes, first of all, that the troops will incur considerable losses essentially over the entire field of their operations and for the entire duration of the battle rather than for a short time and in a limited territory, and , secondly, that medical aid to the afflicted at the stages of medical evacuation during the

battle will be given, as a rule, in reduced volume. These circumstances permit us to draw the conclusion that the content and form of work of the regimental medical aid station, division medical aid station and front-line field mobile surgical hospital will be more or less constant in modern battle. Therefore, there is no need for having two different concepts: "medical aid station" (or front-line field mobile surgical hospital) and "collecting post for the afflicted."

Finally, it is fitting to discuss the terminology in the field of "meditsinskaya razvedka" [medical reconnaissance]. In the literature the terms "reconnaissance performed by the medical service," and "measures for medical reconnaissance" are encountered along with the term "medical reconnaissance."

We believe that the term "reconnaissance performed by the medical service" is unfortunate, because, first, this term does not reveal the essence of the data interesting the medical service (medical reconnaissance [the second term is also used to mean "intelligence"]); secondly, the term limits the definition, saying that all the information of interest to the medical service is obtained directly by it; nevertheless, a considerable portion of the medical service data can be obtained from the staffs and other services. The term "measures for medical reconnaissance" is also unfortunate, because the activity of the medical service in the field of reconnaissance is an integral and very important division of the medical "obespecheniye" [care, but the term includes all kinds of services rendered by physicians, therapeutic and prophylactic] of the troops. It is known, for example, that B. K. Leonardov spoke of the "science of medical reconnaissance" in order to emphasize the significance of the activity of the medical service in the field of reconnaissance.

Therefore, we believe that the term "medical reconnaissance" which has been historically complexified and is definitely understandable to military medical workers should be maintained. By "medical reconnaissance" should be understood the gathering of information concerning the circumstances influencing the state of health of the personnel, the medical welfare of the troops and the activity of the medical service. According to its purpose, medical reconnaissance is divided into the following types: medical-tactical, sanitary-epidemiological and sanitary-chemical. A specific type of sanitary-epidemiological reconnaissance is constituted by measures taken by the medical service in the field of bacteriological reconnaissance. Sanitary-chemical reconnaissance includes certain measures in radia-

tion reconnaissance.

In conclusion, we consider it necessary to express the opinion that the problems of military medical terminology should be discussed more extensively on the pages of the press. Perhaps, it will be expedient later to create a special board, made up of representatives of the various military medical specialties, for the purpose of analyzing these problems and standardizing military medical terms.

## Special Training of Aid Men and Medical Instructors for Work at Night

I. N. Polyakov, Lieutenant Colonel of the Medical Service

The principal form of sessions that we carried on with medical aid men and medical instructors during the training of them for work under night conditions was constituted by group exercises in a certain locality against the background of a given tactical situation with practical solving of training problems. This was preceded by special sessions, at first in the daytime and then at night, which had the aim of training the participants in the exercises in the various elements of working under simpler conditions, of reinforcing their practical habits and of evaluating their readiness for the solution of training problems at night against a background of a given tactical situation. The training of the men was planned so that there was one session a week lasting two or three hours. In accordance with this a list of the sessions was made out, which was approved by the senior physician of the unit.

Unit physicians and the best trained feldshers were made the directors of the exercises. The methodological development of the exercise was also among their responsibilities. In making out the plan all the officers of the unit medical service participated actively in it. In necessary cases recourse was had to consultations with senior comrades. The methods worked out were approved by the senior physician.

At the sessions in the unit where P. A. Novikov works as senior physician, the following principal problems were worked out: orientation to the locality at night; the approach to the wounded person (or afflicted person) and dragging him into a shelter; the utilization of natural shelters; rendering first aid to the wounded (or afflicted) with consideration of the place and nature of the affliction and the circumstances; the designation of shelter sites, the use of signals in the work of the aid man and of the medical instructor on the battlefield; the organization and direction of the work of aid men on the battlefield or in a focus of large-scale casualties.

The training problems were worked out at each session, as a rule, comprehensively as a rule, whereby the inculcation of practical habits into those being trained for work under battle conditions was accomplished. The sessions were carried out in groups of 8 to 12 persons. Mediators (feldshers) were put at the disposal of the leader of the session

in the larger groups for the purpose of regulating the operations of the trainees. Otherwise, it would not have been possible effectively to control the operations of the trainees, which, naturally, leads to a decrease in the quality of the work.

We gave considerable attention to the training of the exercise leaders themselves. Instruction-methodological exercises were carried out with them on the most difficult topics. By way of training for night exercises we also brought in trainees who independently studied the recommended literature under the supervision of the leader.

Directly before the exercises by the order of the unit commander the participants in the exercise were given a longer after-dinner rest (up to three hours). Before going out into the field the leader checked the degree of preparedness of the trainees for the exercises. Deficiencies revealed thereby were immediately eliminated.

The method of daytime sessions was different, according to our method, but most often we began them with checking of the knowledge of the trainees and orientation of them to the terrain, posing specific problems. This method was most acceptable in the initial period of the training. In the orientation to the terrain the landmarks which could be made out at night were outlined, and the azimuths of possible directions of movement of the unit and the sites for organization of shelters for the wounded, etc., were determined. All this considerably facilitated the work of the trainees and assured a better quality performance in the tasks of seeking out the wounded and rendering first aid to them.

In our opinion, under battle circumstances it is also necessary to strive for the orientation of the aid men beforehand (by day) with respect to the field of the forthcoming battle. In cases where there is no such possibility it is necessary to orientate the trainees to the terrain directly before the battle, utilizing terrain features and landmarks which may be made out at night.

Before the exercises signals were established and determined, which is very necessary for coordinated operations of the trainees. In the determination of the signals we were guided by the fact that they should be simple and as few as possible. A firm knowledge of the signals was an invariable condition not only for the leaders of the exercises but also for all trainees. Usually, two signals were established: "call for the medical instructor" and "evacuation required."

The signals were given with an electric lantern, utilizing arbitrary signals for this, for example, three

red light signals; three with a green light at one-second intervals. After receiving the signal the one to whom it was addressed also responded with the arranged arbitrary signal (for example, the alternation of red and green light signals). The signals arranged were coordinated with the respective commander.

The night exercises were begun, as a rule, with a short introductory session in which the leader reported the topic of the exercise, the aim of training and the training problems which needed to be worked out. The tactical and medical situations were reported to the trainees and the commander's decision was presented, after which the landmarks, azimuths and signals were clarified (taking into consideration the content of the problem to be worked out and the need for it). For practical working out of the training problems the trainees were divided into two groups; in the first of them the trainees were included who carried out the part of company aid men and the company medical instructor; the second group consisted of the arbitrarily wounded. Afterwards, the trainees changed roles. In making this division we were guided by the consideration that all the problems of the exercise were to be worked out completely during the training hour.

Before the orderlies started their advance behind the advancing formation of skirmishers of the unit they left their overcoats and packs at the starting position, after which they set about working out the practical methods. The exercise leader at this time observed the operations of the trainees, directed special attention to the quality, time needed for accomplishment of the method and the adaptation of the operations to the circumstances and the terrain. In supervising the practical operations of the trainees the leader made use of a pocket flashlight. The errors detected were eliminated on the spot. In necessary cases, leading questions were posed.

The time spent in rendering medical first aid at night, according to our calculations, increases by an average of 25-30 percent compared with the daytime depending on the nature of the afflictions and the required volume of medical aid. For example, the application of an improvised splint for a gunshot fracture of the thigh took an average of 9 to 11 minutes in the daytime; at night, 13-15 minutes when done by the same persons. As a result of training this difference in time was reduced and was brought nearer to the times required for rendering first aid in the daytime.

It should be taken into consideration that among the trainees a considerable range of night vision was noted. Thus, some of them oriented relatively readily to a terrain

with a radius of 30-35 meters, whereas others under the same conditions could not do this at a distance of 15-20 meters. At subsequent exercises the great majority of the participants orientated themselves better than in the initial period.

For the purpose of determining the nature of the affliction and the medical aid required for those afflicted, particularly in the severe cases, it was necessary to use a flashlight. Without it, as experience has shown, the proper operations of the trainees are impossible, and, therefore, also of aid men under battle conditions.

In training the aid men and medical instructors the most complex problem proved to be finding the afflicted on the battlefield. In working out these problems we made use of instructions given in the appropriate guide book. The distances between the orderlies in the formation amounted to 15-20 meters depending on the nature of the terrain and the degree of darkness, which assured the finding of those afflicted.

Under modern battle conditions at night illuminating measures (projectors, mortar shells, bombs, rockets, etc.) would be used extensively, which should be utilized indisputably by aid men for seeking out and rendering aid to the afflicted on the battlefield. After finding the afflicted person, the aid man (or medical instructor) gave him medical first aid and gave the signal for the need of evacuation. In the event the signal was not returned by the litter-bearers the aid man placed an arbitrary sign at the place of finding the afflicted person and continued this advance behind his unit.

In working out problems associated with sheltering the wounded from secondary afflictions, proper habits of utilizing natural shelters were inculcated into the trainees and, as an extreme case, a small dugout was permitted. Dragging those afflicted was permitted for a distance of five to ten meters. For the purpose of designating the shelter sites for the afflicted we used special signs set up at a height of one meter from the ground.

In the course of the exercises the trainees were given certain hypothetical situations with concrete circumstances, as a result of which the exercises progressed in a more lively manner and required strenuous and planned work on the part of the trainees. At the end of each session a five to seven-minute analysis was conducted, in which the leader presented the results, noting the errors committed at the exercises as well as the better trainees.

## Changes in Preserved Blood During Storage and Transportation on Ships

M. V. Portnoy, Lieutenant Colonel of the Medical Service

Problems of transporting preserved blood by terrestrial and air transportation have been studied in adequate detail and discussed in the works of S. I. Spasokukotskiy, V. N. Shamov, A. A. Bagdasarov, A. N. Filatov, V. Ya. Braytsev, F. R. Vinograd-Finkel', P. L. Sel'tsovskiy, I. A. Kassirskiy and other authors. The solution to these problems made it possible during the years of the Second World War to transport preserved blood from the installations of the far rear to the front and to use it on a broad scale for transfusions not only in field hospitals but also at the forward medical aid stations.

At the same time, it should be noted that the problems of transportation of preserved blood by sea, including on fighting ships, remained absolutely unstudied until the past war. Nor was there any unanimous point of view on the organization of blood transfusion on the ships. P. I. Pokrovskiy and certain other authors, believing that preserved blood cannot be stored and utilized for transfusion on fighting ships, proposed making use of blood from ship personnel donors for the transfusion. Such an organization existed in foreign navies. However, at the end of the war many surgeons (Yu. Yu. Dzhanelidze, G. V. Punin, M. S. Lisitsyn, N. G. Kartashevskiy and others) came to the conclusion that there was a need for supplying ships with a stock of preserved blood. The first observations on the preservation and transportation of citrated blood on ships in the Soviet Navy were made by N. S. Timofeyev in 1943. In 1954, M. F. Mukhin carried out investigations on the transportation of glucose-citrated blood on cruisers.

The experience of the Second World War showed all the advantages of transfusion of preserved blood under war circumstances; it also showed the need for utilizing various types of naval transport for providing blood for the battle operations of the navy. Under conditions of prolonged voyages of the ships the study of the problems of transportation of preserved blood by sea is of importance in peace time also.

Taking into consideration what has been stated, we set before ourselves the following problems: to establish the possibility of preservation and transportation of preserved blood on ships and passenger vessels; to determine the permissible periods for keeping preserved blood on the various ships under conditions of prolonged voyages; to study

the efficacy of transfusions of preserved blood transported by sea when it is used for the transfusion of patients, and to draw practical conclusions in accordance with this.

In the course of accomplishing the work on cruisers, destroyers, mine sweepers and torpedo boats as well as on passenger vessels, we performed 247 experiments (see Table 1).

Table 1

Number of Experiments Performed on Various Ships and Vessels

| Classes of ships | Number of experiments performed | | | |
|---|---|---|---|---|
| | In ampoules | Small bottles | Total | Controls |
| Cruisers | 37 | 42 | 79 | 60 |
| Destroyers | 20 | 31 | 51 | 31 |
| Minesweepers | 10 | 25 | 35 | 28 |
| Torpedo boats | 16 | 36 | 52 | 46 |
| Passenger vessels | 11 | 19 | 30 | 30 |
| Total | 94 | 153 | 247 | 195 |

In performing the experiments, 94 ampoules and 153 small bottles of blood preserved in TsOLIPK [Central Order of Lenin Institute of Blood Transfusion] No 7 solution [this solution contains glucose and citrates] were preserved and transported on the ships and vessels mentioned, and 226 ampoules and small bottles of blood of the same donors were preserved at an optimum temperature in a state of rest and served as controls. Preserved blood was transported which had been kept from one to 20 days from the time of preparation. The duration of storage and transportation of it on ships was also varied (see Table 2). On the ships the experiments were performed mainly during the accomplishment of battle training tasks; on the passenger vessels -- when they took long voyages.

Preserved blood on the ships was kept at a temperature of from 1° to 10° in refrigerators and low-temperature rooms. For the purpose of studying the effect of harmful factors on blood during storage and transportation of it on the ships the changes in the osmotic resistance of the erythrocytes, their shape, color and property of rouleaux formation were determined; the number of erythrocytes and leucocytes was determined, and hemolysis was checked. The sick and wounded were transfused in hospitals with blood which had been transported in ampoules. The condition of these patients was observed, and a study was also made of the change in

hemoglobin, erythrocytes and urine of patients during the first few days after blood transfusions.

Table 2

Duration of Storage and Transportation of Blood on Ships and Vessels

| Classes of ships | Number of experiments for each period of storage and transportation of blood | | | | | |
|---|---|---|---|---|---|---|
| | 6-12 hrs. | 1-5 days | 6-10 | 11-16 | 16-20 | Over 20 days |
| Cruisers | -- | -- | 5 | 41 | 10 | 23 |
| Destroyers | -- | 4 | 30 | 9 | 8 | -- |
| Minesweepers | -- | 3 | 10 | 14 | 8 | -- |
| Torpedo boats | 52 | -- | -- | -- | -- | -- |
| Passenger vessels | -- | -- | -- | 16 | 14 | -- |
| Total | 52 | 7 | 45 | 80 | 40 | 23 |

The investigations confirmed the data of many authors (F. R. Vinograd-Finkel', M. Ye. Depp, A. D. Belyakova and others) to the effect that with standing a decrease in the osmotic resistance of the erythrocytes, gradual change in the shape of the erythrocytes from biconcave to spherical, a decrease in the intensity of the natural color and loss of the property of rouleaux formation occur in the preserved blood. The leucocyte count is decreased, and later, that of the erythrocytes; the formed elements are destroyed. All these changes are observed both in transported and in control blood. However, in transported blood the changes mentioned are found earlier than in the control. This leads to the earlier occurrence of hemolysis of the transported blood and a decrease in its time of suitability for transfusions.

The cause of the earlier occurrence of the degenerative changes in the transported blood is made up of mechanical factors which act on the preserved blood during the period of storage and transportation. On ships and vessels they are connected with vibration as a result of the operation of the mechanisms, rolling, and sharp jolts to the body of the ship from the firing of weapons.

The mechanical effect on the preserved blood is expressed to different degrees on various classes of ships and passenger vessels. With storage and transportation of the preserved blood on the large ships and passenger vessels it is subject to an insignificant shaking. Usually, only an

indistinct boundary was noted between the layer of formed elements and the plasma, and in certain experiments even these data were not found, despite the fact that the voyages of the ships and vessels were made in a wind of considerable strength. With the reduction in displacement of the ships the degree of shaking of the preserved blood on them increases. However, the preserved blood is subjected to severe shaking only on the torpedo boats, whereby a uniform mixing of the formed elements of the blood with the plasma and the formation of foam occur. This leads to a more rapid loss of the rouleaux properties of the erythrocytes, slowing of the sedimentation rate and a reduction in the plasma layer. No destruction of the formed elements is observed even during transportation on torpedo boats.

The strength of the wind affects the condition of the preserved blood differently when it is transported on various ships. With increase in the strength of the wind during transportation on the small ships the degree of shaking of the blood increases and the time for occurrence of hemolysis is shortened.

An exceptionally important factor in the transportation of blood is the length of time it is stored from the time of preparation. As a result of transportation on ships and vessels of preserved blood which had been prepared one to five days before, hemolysis occurs, on the average, 2 to 3.6 days sooner than in the control. The investigations show that the longer the time from preparation to transportation of the blood the sooner hemolysis of it occurs. Latent hemolysis in the transported blood was found in the majority of experiments earlier than in the control blood. The reduction in the osmotic resistance of the erythrocytes and other indices is directly related to the time the blood is prepared. The difference in the indices of osmotic resistance of the erythrocytes between transported and control blood reaches, on the average, 0.04-0.08 percent sodium chloride solution. In various groups of experiments it reaches 0.06-0.12 percent. These deviations are also expressed on the small vessels to a greater degree. When the length of storage and transportation of fresh preserved blood on the large ships and passenger vessels was 15-20 or more days the difference in the time of occurrence of hemolysis increases insignificantly in comparison with the control.

Transportation of blood on ships does not lead to any disturbance in the standard packing of the ampoules containing blood; in selective bacteriological checking microbial contamination of it was not found even once. It was noted that the transportation of blood in partly filled

small bottles leads to an earlier occurrence of hemolysis than when they are filled to the top.

In the Naval Hospital 108 transfusions of transported blood were performed. In addition, there are data available concerning 21 transfusions of blood which had been stored and transported for a long time on a cruiser. The blood was transfused in a quantity of 25-500 cubic centimeters from 3 to 33 days after its preparation. The transfusion of transported blood gave the same therapeutic effect as the transfusion of non-transported blood. As a result of the transfusion of 260 cubic centimeters of transported blood an increase in the hemoglobin by an average of 5.8 percent was noted in the patients and in the erythrocyte count by 490,000 per cubic millimeter of blood. These figures are in agreement with those in the literature (V. Ya. Protasov and others) which were obtained after the transfusion of a similar quantity of non-transported blood. There were no complications from the transfusion of transported blood in the hospital or on the cruiser, and transfusion reactions were not seen any more frequently than after the transfusion of non-transported blood.

## Conclusions

1. During transportation on cruisers, destroyers, minesweepers and passenger vessels, preserved blood is subjected to only insignificant mechanical action. On torpedo boats a uniform mixing of the formed elements of the blood with the plasma occurs, and after transportation a delayed sedimentation of the formed elements of the blood is observed, an increase in the globular layer and a more rapid loss of the property of rouleaux formation by the erythrocytes.

2. During transportation on the ships and vessels a somewhat accelerated development of the degenerative processes of the formed elements occurs in the preserved blood, which leads to the earlier occurrence of hemolysis.

3. Increase in the time the preserved blood is stored prior to transportation contributes to the more rapid development of degenerative processes of the formed elements and to the earlier occurrence of hemolysis. Particularly marked changes are found in blood which has been stored for 10 days after preparation prior to its transportation.

4. Preserved glucose-citrated blood which has been prepared one to five days before transportation on cruisers, destroyers, minesweepers and passenger vessels can be kept at an optimum temperature, transported and transfused for 26-28 days.

## The Question of Suitability for Submarine Service in Those With Abnormalities of the Bite

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In the selection of draftees for service on submarines, military medical boards have difficulties with respect to the evaluation of suitability of persons with bite abnormalities. This matter has not been clarified in the directives for examination of draftees. At the same time, a submariner needs an intact masticatory apparatus, as does also every shallow-water diver for the prolonged maintenance of the mouthpiece of the breathing apparatus in his mouth. Taking these facts into consideration, we decided to make special investigations.

It is known that the abnormalities of the dentition are divisible into many types. In this case, we were interested in abnormalities of the bite which could be a contraindication to carrying out service on submarines or for carrying out shallow-water diving duties, namely: open, closed, prognathous and progenic bites. With the aim of working out a system of contraindications to service on submarines we examined 10 persons 20-22 years of age with various bite abnormalities. Thereby, it was taken into consideration that in emerging from a damaged submarine the submariner would hold the mouthpiece in the breathing apparatus by special cleats with his canine teeth and bicuspids. In the case of an abnormality of the bite and an absence of these teeth the mouthpiece cannot be kept in the mouth. We took into consideration also the fact that in the submariner's insulating outfit there is at present a special cheek strap for the purpose of keeping the mouthpiece in the mouth.

Each subject was first examined by a stomatologist and a physiologist who established the type of bite abnormality and determined the ability to keep the mouthpiece of the breathing apparatus in the mouth. Then, the subject studied the rules of utilization of the insulating respiratory apparatus and dove under the water. The subjects remained for 60-75 minutes under the water in the insulating breathing apparatuses. In this time the possibility of respiration under water in the insulating apparatuses in the case of persons with various bite abnormalities, fatigability of the masticatory muscles and the amount of gas mixture used were determined.

As a result of the examinations it was found that in

the case of an open bite of up to four millimeters inclusive, where there is proper occlusion of the teeth in the area of the canine teeth, bicuspids and tricuspids, the mouthpiece is held firmly. No rapid fatigability of the masticatory musculature and lips occurs. The consumption of the respiratory gas mixture is no greater than normal. In the case of some bite abnormalities (open bite of more than four millimeters, closed bite, prognathic bite) a person is capable of keeping the mouthpiece in his mouth under water for a certain time by straining his masticatory musculature and lips. However, with fatigue of the masticatory muscles and lips gas begins to come out of the mouth continuously, and the subject loses the power of holding the mouthpiece. In these cases, the use of a cheek strap is essential; we had recourse to this repeatedly during the examinations. The observations showed that the cheek strap holds the mouthpiece in firmly, but does not prevent the leaking of gas out of the mouth after fatigue of the masticatory musculature and lips occurs. It is entirely natural that the continuous leakage of gas through the mouth can lead to the development of signs of anoxia.

Therefore, the investigations which we made showed that persons selected for service on submarines should have a good masticatory apparatus, and a proper bite of the bicuspids, tricuspids, and canine teeth. For the purpose of holding the mouthpiece of the breathing apparatus we allow an open bite of only the central and lateral incisors of up to four millimeters, but thereby the bite of the bicuspids, tricuspids and canines should be normal. Persons who have an open bite of more than four millimeters, a closed bite with traumatization of the gum margin, prognathous and progenic bites with failure of occlusion of the front teeth by more than four millimeters as well as persons who have eight to ten carious teeth are unsuitable for submarine service, in our opinion.

# The Change in the Functional Mobility of the Retina of the Eye After Cooling of the Body

N. I. Bobrov, Colonel of the Medical Service
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The task of the present work was the study of the changes in the functional mobility of the retina of the visual analyzer which occur from the effect of cold, with the aim of utilizing these data for evaluating the indices of adaptation of personnel to the cold under conditions of service in the Arctic.

As is known, the visual analyzer is the most corticalized, and hence the most perfect "device," possessing the capacity of the finest analysis and synthesis. In connection with this, it was in order to assume that the changes in the functional mobility of the retina of the visual analyzer detected after the effect of cold can be utilized for characterizing the functional reorganization in the cerebral cortex.

The functional mobility of the retina of the eye in personnel of the Arctic Fleet was studied by means of scotometry, a method which is simple and gives very accurate results. The area of projection of the blind spot was measured by means of the scotometer of the S. F. Libikh and N. I. Matuzov design, which makes it possible to record the outlines of the blind spot for 18-36 radii in three or four minutes. (The design of the device is described in the article by S. F. Libikh and N. I. Matuzov in the collection of innovations for 1953-1954 of the "VMMA" [Naval Medical Academy], Leningrad, 1955, pages 9-11.)

For the purpose of the examination, a group of ship specialists was selected (gunlayers, signalmen, helmsmen, engine mechanics, machinists and electricians) totalling 88 persons with normal vision. In this group were included 38 persons who had served in the Arctic for less than a year, and 50 persons who had been in the Arctic for three or four years or more. The billeting and feeding conditions of all the subjects on the ships were the same.

The observations were made in March from noon to 2 p.m. in the quarters of the unit medical service using natural light. The degree of illumination on the scotometer screen was equal to 150 luxes. For 40 minutes the subjects adapted themselves to the microclimate of the room and the brightness of the scotometer screen. After the adaptation time had elapsed the area of projection of the blind spot was determined in each subject, after which the subjects immersed their lower extremities in water with a temperature

of 5-6° for five minutes. Before concluding this five-minute cooling period of the extremities the area of projection of the blind spot was determined again. The projection area of the blind spot was measured with a planimeter according to the outlinesdelineated.

The results of the observations, which were treated statistically, in accordance with the service periods of the subjects in the Arctic, are presented in the Table.

Change in the Area of Projection of the Blind Spot Under the Influence of Cooling Depending on the Period of Service in the Arctic

| Period of service | No of subjects | Average area of projection of blind spot in square centimeters | | Difference in average values before and after cooling | Coefficient of probability |
|---|---|---|---|---|---|
| | | Before cooling | After cooling | | |
| Less than a year | 38 | 9.1 | 12.3 | 3.2 | 0.99 |
| 3-4 years | 50 | 12.6 | 13.1 | 0.5 | 0.67 |

From the Table it is seen that the area of projection of the blind spot before cooling in persons who had been a short time in the Arctic was less than in the old service men. Under the influence of cooling in persons who had service of less than a year the area of projection of the blind spot increased substantially, and in those who had served there for three to four years or more the increase in the projection area of the blind spot under the influence of cooling was insignificant, and, according to statistical laws, chance. In the analysis of the individual variations in the projection area of the blind spot it was noted that changes in it during cooling were chiefly constituted by an increase. A decrease in the projection area of the blind spot under the influence of cooling was observed only in individual persons.

The results of the observations treated in accordance with the specialty and term of service of the subjects are of great interest. Such an analysis makes it possible to study the nature of the reaction to cooling in persons who have been in the Arctic for the same time but who service battle posts on the upper deck, and therefore are exposed to cooling (gunlayers, helmsmen, signalers), and those

working inside the ship in a normal or elevated temperature (machinists, communicators).

After cooling of the lower extremities the increase in projection area of the blind spot was greater the shorter the time the subject has spent in the Arctic and the less he had been exposed to the effect of cold on watch. In accordance with this, the greatest changes were observed in the machinists and communicators who had been in the Arctic less than a year, and the least, in gunlayers, helmsmen and signalers who had had service of three to four or more years.

The values of the coefficient of probability computed show that differences in the projection area of the blind spot were significant only in the first three groups of subjects. In the gunlayers, helmsmen and signalers who had been in the Arctic for three or four or more years the changes in the projection area of the blind spot under the influence of severe cooling were chance.

P. G. Snyakin's investigations have established the fact that the area of the blind spot may vary within considerable limits -- from 8 to 25 square centimeters in some subjects and from 10 to 28 square centimeters in others. As the results of these investigations have shown, the change in the area of the blind spot is a physiological adaptive reaction to conditions of natural lighting; the greatest area of the blind spot is found during the brightest part of the day, when a considerable number of light-sensitive elements in the vicinity of the blind spot are inactivated; the least, at the beginning and end of the day.

In the majority of subjects in our observations the area of projection of the blind spot before cooling was within limits of 7.8-14 square centimeters. The comparatively small projection area of the blind spot in the subjects may be brought about by the fact that the intensity of the natural illumination in the Arctic was small at the time of the observations.

A five-minute stimulation of the skin receptors by cold in our observations led, in the majority of cases, to an increase in the area of the blind spot. The fact in itself of a change in the functional condition of the visual analyzer after stimulation of other analyzers has been known a long time. Thus, N. Ye. Vvedenskiy in 1879 detected the increase in skin sensitivity after passing from a darkened room into a bright one. Later, I. V. Godnev pointed out the change in sensitivity of the skin receptors under the influence of stimulation of the visual analyzer. P. P. Lazarev, P. O. Makarov, S. V. Kravkov, N. A. Vishnevskiy, A. N. Bogoslovskiy and many other authors have observed the change in

sensitivity of the visual analyzer under the influence of indirect stimulation. However, in some cases under the influence of indirect stimuli the sensitivity of the visual analyzer was increased; in others, it decreased. The results of these observations permitted A. V. Lebedinskiy to draw the conclusion that the strength of the indirect stimulus and the experimental conditions play a determinative part in the final effect.

The works of these authors give us the basis to suppose that marked cold stimulation of the skin receptors in our observations produced an ultraboundary protective inhibition in the cerebral cortex with irradiation of it to the visual centers. This was manifested in an inactivation of part of the light sensitivity of the elements and an increase in the area of the blind spot. The inhibition of the optic nerves was expressed to a greater degree in persons who had not been trained to the effect of cold or who had not been very much exposed to the effect of the severe Arctic climate. In persons who had had long terms of service in the Arctic, particularly in those who stood watch in the open air, the inhibitory effect from cooling was expressed to a much lesser extent and was not always adequately demonstrated.

Therefore, the effect of cold which is systematically repeated from day to day, according to our data, leads to a localization of the ultraboundary inhibition in the cerebral cortex, which occurs from marked cold effects. As a result of the systematic effect of low temperatures the intercentral interconnections in the cerebral cortex are rearranged, which leads to a change in the reaction not only to direct but also to indirect stimuli.

Therefore, the functional changes which occur in the activity of the visual analyzer on cooling, which is manifested in a change in the area of the blind spot, can serve as indices of the degree of adaptation of the body to the cold.

The results of our observations differ from the data of the investigations of K. Kh. Kekcheyev and A. V. Lebedinskiy, who obtained an increase in light sensitivity of the eye after the effect of cold. This discrepancy is apparently explained by the fact that in the experiments of the authors mentioned open parts of the body were cooled which during everyday activity were exposed to the effect of the cold and the wind, as well as by the inadequate degree and duration of the cold influence.

## Conclusions

1. A severe cold effect on the lower extremities

produces an inactivation of light-sensitive elements of the retina of the eye in persons not adapted to the cold, which is manifested in a considerable increase in the blind spot area.

2. In persons who have served under Arctic conditions for a long time and who have been exposed constantly to the effect of cold, no essential changes were noted in the blind spot area under the influence of severe cold effects.

3. The data obtained by means of scotometry can be utilized for the evaluation of the adaptation of the body to cold.

# Medical Control in Catapult Training

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Lately special means intended to protect the flight personnel against untoward flight effects and also rescue equipment for emergency situations have become so complex that their use without training and periodical retraining becomes practically impossible.

Basic demands in regard to the flight personnel training in the use of protective and rescue equipment may be boiled down to the following: a practical knowledge of various factors acting on the pilot when special equipment is used in emergency stations, training in the use of protective and rescue equipment: in a pressure chamber, training cabin, etc.; acquisition and automatization of motor habits in controlling such equipment; and training in a correct and timely determination of the moment rescue equipment must be used. Meeting these conditions is of essential importance in training the flight personnel in the use of rescue equipment in flight. Thus, a study of cases of forced catapulting shows that the flight personnel with ground training have one-half to two-thirds of complications and accidents as compared to persons with no special ground training.

Teaching and training flight personnel in the use of catapulting methods can only be sufficiently effectie if the training has been properly organized and the medical control of the trainees has its purpose. We shall dwell in this paper on the medical control problems during training catapulting and on the evaluation of medical data on the effectiveness of training results with a training cabin. Let us first examine certain peculiarities of training organization which bear on its effectiveness.

In the course of training, the man is subjected to the effect of unfavorable factors which are likely to be responsible for one's negative attitude to the training and which lower its effectiveness in the absence of adequate explanation and individual approach. The negative attitude toward the training comes about as a result of the erroneous idea as to the harmfulness of the factors in effect and the concern about one's health. This can particularly often be observed in persons who start training for the first time.

Many an extraneous cause, primarily the environment where the training takes place, can bring forth or deepen one's negative attitude toward the training. Conditions

unfavorable to training sometimes are created through improper medical approach to the pilots' examination, [original illegible] revealing preparations for medical aid rendering, the compulsory nature of training itself, etc. It is therefore important that all problems pertaining to the training organization be placed under the control of the flight surgeon who takes part in flight personnel special training.

The scope of medical examinations during training catapulting should be subordinated to the main objective, which is teaching the flight personnel the faultless routine of the catapulting method. Conditions under which medical examinations take place and certain medical examination procedures should not cause the flight personnel's anxiety for their health. Should the necessity arise, before the training catapulting, for medical flight fitness examination, its extent must be reduced to the very minimum.

When deciding on the question of permission for catapulting, the medical control should be aimed toward the goal of having all crew members on planes with catapulting equipment take compulsory ground training and be prepared to use rescue equipment in special flight cases. Medical control pays particular attention to giving catapulting permission to persons on the very training day; the study of peculiarities of physiological reactions in various persons, evaluation of training effectiveness on individual persons from medical data, training organization control, and provision for trauma prophylaxis.

While conducting medical examination and recording various physiological functions their importance in training catapulting should be explained. The trainee must know that the medical examination has not been caused by anxiety about the effect of catapulting on the organism, but that it serves the purpose of choosing a larger group of persons for training on the basis of the study of individual physiological reactions as well as for the purpose of controlling the training effectiveness. Particular attention should be paid to the prophylaxis of incidental and accompanying traumas during the training. Traumas and a poor training organization reinforce the flight personnel's negative attitude toward the training.

Considerable stress on nervous activity and an extremely brief period of useful consciousness in an emergency situation are conditions conducive to various errors in catapulting; they require that all pilot's actions needed for bailing out of the plane be reduced to complete automatism and performed in the minimum time. Taking into account the favorable effect of the flight personnel ground training

on the outcome of forced catapulting, one must keep improving the methods and organization of such training.

The ground training must be aimed at the solution of at least three main problems: first, help aquire procedures for a quick and proper posture assumption in the ejection seat and maintain it under the effect of g; second, acquire and automatize motor habits in regard to precision and sequence of manipulating, expressed in the more or less prolonged (measured in seconds) impediment of motor reactions and considerable strengthening of vegetative functions. Examination of physiological reaction in trainees will enable the flight surgeon to estimate individual tolerance of the effect applied as well as the effectiveness of ground training.

By this time test data have shown that slight changes in physiological functions are observed during the first (less frequently second) catapulting. As catapulting is repeated, a reduction in functional shifts takes place despite that the force of the factor is effect (g) grows at the same time. Typical changes in pulse rate and arterial pressure during training are illustrated in Fig. 1.

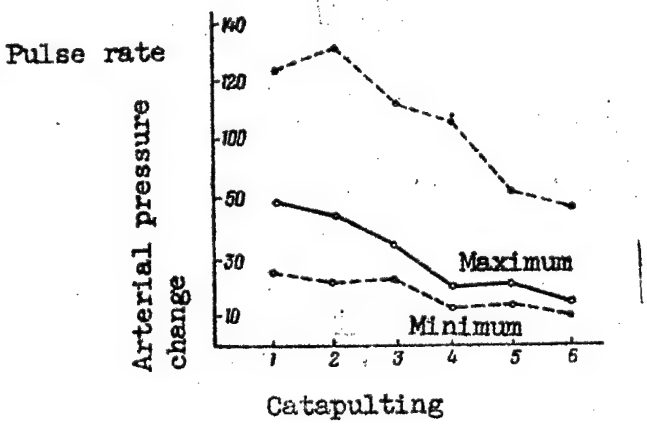


Fig. 1. Pulse rate and arterial pressure changes in the process of repeated catapultings

Analogous regularity during repeated catapulting is also observed in the change of conditioned vascular-motor reflexes (Fig. 2). After the initial effect, the usual vessel constriction reaction to either conditioned or un-conditioned reflex is absent. When catapulting is repeated, reaction comes back despite the fact that g doubles.

If one compared changes in pulse rate and arterial pressure after the catapulting in trainees undergoing it

for the first time and in those who took training many times, one would notice that the latter have a considerable decrease in functional changes in the cardio-vascular system (Fig. 3). The reduction is typical of the majority of people subjected to repeated ground catapulting. The first is encountered in persons prone to excitability, with a labile pulse rate and pronounced vasomotor symptoms; it manifests itself in either increase in functional deviations upon each succeeding catapulting or in their preservation on the high initial level. This nature of functional changes is evidently associated with the type of nervous activity and peculiarities of blood circulation system regulation.

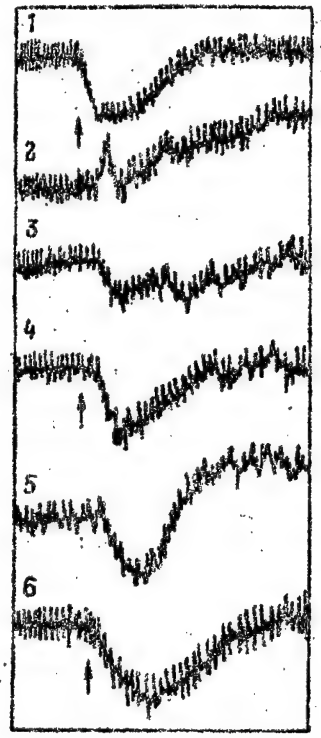


Fig. 2. Changes in vascular-motor conditioned reactions in the process of training.

1-result of examination for three days prior to catapulting Testee S.
2-8--10 minutes after initial catapulting of 10 g
3 and 4-the same after 15 and 21 min.
5- 8-10 minutes after second catapulting of 21 g (arrow - moment of application of conditioned stimulus).

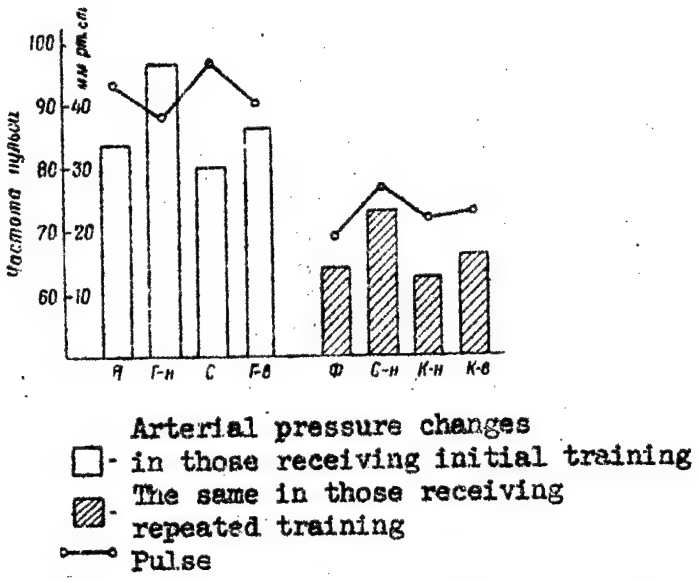


Fig. 3. Pulse rate and arterial pressure changes in individuals receiving initial and repeated training.

The other type of reaction, which is oberved extremely seldom in case of g values created on catapulting trainers, manifests itself in pulse rate deceleration, a drop in arterial pressure, appearance of paleness, cold perspiration, trembling hands, complaints about poor feeling, etc. The reaction is associated with the indirect effect of a considerable mechanical force on the organism; it is characterized by functional weakening of defensive and adaptative mechanisms like in many other cases of traumatic effect. Manifestations of the second type reaction in the form of individual symptoms of disruption in the cardio-vascular system function maybe indicative of a poor tolerance of catapulting. Increase in such symptoms upon repeated catapulting makes any further training useless.

Continuous electrocardiography is an effective measure of medical control during the training catapulting. An electrocardiogram discloses variations in sinus rhythm reflecting the physiological reaction to the training environment and conditions. Sinus arrhythmia attains the highest degree prior to catapulting in some persons; after catapulting, in others. Greatly pronounced during first catapultings, sinus arrhythmia gradually decreases in the process of training. Furthermore, the degree of sinus arrhythmia prior and after catapulting evens up, which may, to a certain extent, serve as an indicator of the positive training effect. More pronounced distur-

bances in the cardiac rhythm during catapulting do occur, as a rule. In individual instances (one to two percent), extrasystoles may be detected immediately before and after the g effect in persons with a labile pulse due to functional cardiac activity when the general excitability of the organism is higher.

A relative slowdown of cardiac contractions in the first three to five seconds after the catapulting represents a specific reaction to the mechanical effect during catapulting. Such decelaration is observed in 80 percent of the trainees; it appears in electrocardiogram as an expanded R-R interval immediately after g. Larger P deflections prior to catapulting and smaller T and R deflections afterwards are the most characteristic electrocardiogram changes. At the same time, one to two minutes after the catapulting, one may often observe shortening of R-T interval, whhch is one of the symptoms of the vagus nerve inhibition effect. Electrocardiogram changes prior to cat, being associated with an increase in the sympathetic nerve effects, and changes immediately after catapulting, being indicative of an increase in the vagus nerve effect, should not give reason for particular apprehension since they reflect the physiological regulation of cardiac activity when it is stimulated externally.

A systolic indicator during catapulting does not change, as a rule. The cardiac electric axis deflection after every application of the effect is observed in opposite directions, which is associated with the varying nature of the shifting of internal organs upon momentary application of the force during catapulting. These cardiographic changes, if they are of brief nature, do not contraindicate the continuation of training.

The above examined changes in the functional activity of the cardio-vascular system during catapulting have a certain regularity, as this has been shown in the foregoing. Deviations from this regularity in the training processes are of the same essential importance to the medical control of its effectiveness. Primary attention should be paid to the study of motions related to catapulting and evaluation of accuracy and speed of their execution. One must also take into account the sequence of actions and the presence of wrong or unnecessary motions during the training. Acquisition of motor habits in trainees can be judged not only by the accuracy of motions but also by chronometric data covering the entire training process and catapulting performance as well as through recording of individual motions related to ejection seat minipulation.

Filming of those catapulting during the training can furnish a more complete characterization of the acquisition of motor habits that are needed during catapulting. The analyses of individual film frames makes it possible to determine time, trajectory of motions and the accompanying errors, and follow a change in posture when g is actually in effect. To achieve this purpose, filming is done at the rate of at least 40-50 frames per second.

Training catapulting helps acquire habits needed for manipulating seat levers and develop a proper posture. When a man is catapulted for the first time, his head, as a rule, jerks forward. Head jerking at the moment of g effect becomes less pronounced during subsequent training with higher g's; certain persons may have no such head jerking at all. The very same thing is also observed in regard to the position of arms and legs, placement of the body with reference to the back and seat, etc. Thus, checking posture correctness and its maintenance during the catapulting serves as one of the criteria of training effectiveness.

Three stages of changes depending on one's training and the magnitude of the factor in effect may be noted in the nature of disruptions of the initial position of the man subjected to strong mechanical effects upon catapulting (accelerative stress, air stream). During the first stage -- at the beginning of training -- considerable changes in the initial posture predominate and are disproportional to the magnitude of the factor applied. During the second stage, as the effect is repeated and the factors applied are magnified, changes go down. Acquisition of the necessary muscular reactions during this period and assumption of proper initial posture enable the trainee to counteract actively forces created during the catapulting; they also raise his resistance as a whole. From the viewpoint of tolerance of strong mechanical effects, the second stage may be termed a stage of compensative stresses. A further increase in g (or air stream) again begins causing substantial deviations in the initial posture which are no longer restored during the training; as to their nature, they are subthreshold changes (the third stage) and call for protective measures and devices to eliminate them.

Training effectiveness can very well be evaluated by indicators such as time of preparatory actions, time lapse between the catapulting moment and the execution of the assigned motion afterwards, and accuracy of evaluation of small time intervals between two successive actions.

Our research shows that the time lapse between the application moment and the first assigned motion is brief

upon the first (less often upon the second) catapulting, whereafter it becomes briefer regardless of g (Fig. 4). The accuracy of measuring time intervals during the training is not less instructive. After the first catapultings time estimation usually changes, with acceleration observed in the majority of cases. As a result of such a change, actual time intervals are estimated as being briefer than they are. Thus, a five second interval is assumed to last 3.5-4.0 second; a three second interval, 2.0-2.5 second. During the training the extent of disorders in time estimation goes down. However, acurate reproduction of the assigned intervals takes place only 10-15 minutes after g.

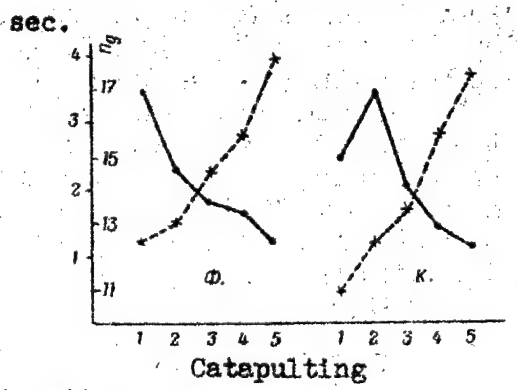


Fig. 4. Changes in time lag for motor reactions in Testees F. and K.

Taking into account that the development and acquisition of motor habits requires a larger number of repetitions than it is possible to attain during training catapulting, the development of motor habit must best take place ahead of time, using for this purpose the crew member's work place. It is necessary that the motor habits developed ahead of time would then be acquired under ground training conditions.

In catapulting man is affected by a complex of strong stimuli, which creates certain difficulties in acquiring motor habit. However, a positive training effect can be attained upon taking into account individual traits and using proper approach to training.

The first catapulting being a strong, unusual, and extreme stimulus for man, it causes generalized stimulation in the cortex of large hemispheres. It is practically impossible in such a state to attain acquisition of motor habits that are needed for catapulting. Hence the first catapulting, which may be called an exploratory one, must

be followed by another, and then by subsequent repetitions in accordance with the accepted training system. Should the second catapulting lag more than a few days after the first one, it again may become only exploratory, which -- as one knows it -- prevents the acquisition of motor habits and the development of differentiation, and is followed by pronounced changes in vegetative functions.

It is utterly clear that a reduction in the shifts of vegetative functions does not constitute the main training objective. At the same time, without data on such reduction during the training, it is impossible to be sure that the acquisition of motor habits needed for catapulting took place against a favorable background, in the presence of a favorable functional condition of the central nervous system, and when the cortex of large hemispheres is under optimum stimulation. A decrease in vegetative deviations, particularly in regard to the cardio-vascular system reaction, indicate, in turn, that the orientation reflex does not prevail in the functional activity of the organism. Under these conditions, there is sufficient reason for the assumption that the acquisition and mastery of motor habits will take place firmly and reliably.

## Conclusions

1. Medical control of training catapulting must comprise not only trainees' examination prior and after catapulting, but also all training organization aspects.

2. To increase training catapulting effectiveness, one must lower the negative effect of the elements of suddenness, novelty, and danger relative to the process of development and acquisition of motor habits needed for catapulting.

3. A study of the cardio-vascular system, evaluation of changes in the initial posture and the time of motor reactions during the catapulting permit a judgement as to the training effectiveness in the course of medical control.

# Changes in Blood Oxygenation at High Altitudes Depending On Pressure Suit* Effectiveness

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The problem of blood saturation with oxygen (oxygenation) when man stays in the rarefied atmosphere has received adequate treatment in both domestic and foreign literature. However, the majority of studies were conducted at 3000-12,000 m altitudes, while breathing air or oxygen ambient atmospheric pressure. The results of studies enabled the authors to compile special tables of oxygen percentage content in blood at various altitudes (G. G. Gazenko, Ye. Ya. Shapelev, 1953; G. V. Altukhov et al., 1954). The problem of changes in blood organization at high altitudes with pressure breathing has not been elucidated in such detail. Data found in the available foreign literature refer to breathing conditions under excess pressure of 15-30 mm Hg., which does not correspond to the present status of the problem of breathing under excess pressure.

William (Nauchno-issledovatel'skiy ispytatel'nyy institut aviatsionnoy meditainy -- Scientific Research Experimental Institute of Aviation Medicine) carried out in recent years a number of studies on the nature of blood oxygenation while breathing oxygen at high pressure under the ground conditions and at 20,000 m and higher altitudes (A. G. Kuznatsov, 1957; V. B. Falkin et al, 1958, N. I. Vabar et al, 1958). Conclusions they have reached during the study of blood oxygenation at high altitudes boil down to the following. Breathing oxygen at elevated pressure, which aggregates 145 mm together with the atmospheric pressure, blood oxygenation at 20,000 m and higher altitudes varies within a 80-90 percent range. At the same time blood oxygenation at 12,000 m altitude, where the atmospheric pressure likewise equals 145 m when breathing pure oxygen, yet without excess pressure in the lungs, is 85-95 percent. Hence, there is a certain blood oxygenation deficit in pressure breathing, which becomes particularly noticeable when man spends

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*The Russian term used in the text is "altitude compensation suit" (vysotnyy kompensiruyushchiy kostyum).

long time at high altitude. The authors attribute this fact to breathing difficulties and hemodynamic disorders occurring when ordinary types of pressure suits are worn with excess pressure breathing. This paper concerns the examination of blood oxygenation with pressure breathing at high altitudes when improved pressure suits are worn.

We examined six persons in a pressure chamber. Blood oxygenation was determined by "Krasnogvardeyets" factory oxyhemometer 0-38. The original blood oxygenation value was assumed to be 100 percent since the testees were breathing pure oxygen throughout the whole test. Furthermore, while the testee stayed at an "altitude," the following was determined: changes in respiratory movement rate and range as well as in chest perimeter; pressure exercise by the suit against the body in the middle and lower chest area; and pulmonary ventilation.

Twenty-one tests at 20,000 m and higher altitudes were carried out wearing both ordinary and improved pressure suits. Both the ascent and descent were carried out at the same rate of speed. The time spent at an altitude was predetermined by the test program. The results of research showed that blood oxygenation with pressure breathing at high altitude drops. The extent of drop varies and depends on numerous factors. The altitude of ascent is the basic factor affecting the blood oxygenation level. However, oxygen content in blood goes down most markedly upon assending from 12,000 to 15,000 m. A further increase in altitude, while preserving the summary pressure of 145 mm under the helmet affects the blood oxygenation level considerably less. This dependence becomes clearer when wearing improved pressure suits. At 15,000 m altitude, oxygen content in blood averages 90 percent, which is 10 percent lower than theoriginal values; at 20,000 m and higher altitudes, the corresponding figure is 89-89.1 percent, dropping but 1-0.9 percent as compared to the oxygenation at 15,000 m altitude.

The most markedly pronounced drop in blood oxygenation upon ascent to 15,000 m altitude is evidently due to the fact that it is precisely 12,000-15,000 m altitude where breathing under ambient pressure is switched to pressure breathing in the lungs. No such sharp changes in breathing conditions occur upon further ascent.

Oxygen content in blood at 20,000 m and higher altitudes when ordinary pressure suits are worn is close to data obtained in the course of earlier tests (A. G. Kuznetsov et al., 1957; N. I. Vaker et al., 1958; V. B. Malkin et al., 1958). In our tests, however, a certain drop in blood oxygenation was observed as the altitude rose, while in

other authors' tests oxygen content in blood at 20,000 m and higher altitudes practically underwent no change. It is possible this was due to a longer stay of the testees at high altitudes in our tests.

Our research has also shown that oxygen content in blood depends on individual traits of the persons tested. Thus, for example, the most resistant testee, M., had not less than 80 percent of blood oxygenation, while testees, K. and A., who tolerated pressure breathing at high altitudes less well, showed oxygenation drop to 71 and 74 percent, respectively.

The individual blood oxygenation level is evidentally connected with the unequal development of compensation reactions in various persons which fact was stressed sometime ago by G. V. Altukhov, V. I. Voytkevich, N. N. Beller, and other authors who studied this factor in hypoxia at low altitudes. Varying blood content under identical conditions was observed not only in varims testees, but also in the same person in different tests.

The value of oxygen content in blood at high altitudes depends to a certain extent on pressure suit properties. When ordinary pressure suits are worn at 15,000-20,000 m and higher altitudes this value varies from 84 to 80 percent, dropping, in isolated cases, to 74-71 percent; at the same time, while wearing improved pressure suits at identical altitudes, oxygen content in the blood varies from 90 to 89 percent, and only in some tests drops to 82-81 percent. Changes in pulmonary ventilation likewise affect the blood oxygenation level. Pulmonary ventilation with pressure breathing goes down, as a rule, both under ground conditions and at 15,000 and 20,000 altitudes, when ordinary pressure suits are worn; its values are close to the original ones or slightly exceed them in tests with improved pressure suits. This latter fact comes particularly in evidence with excess pressure breathing under ground conditions. Since pulmonary ventilation does not go down when wearing improved pressure suits, oxygen content in blood is probably at a higher level. The results thus obtained make it possible to subscribe to the above-stated assumption that the deficient blood oxygenation with pressure breathing and wearing ordinary pressure suits depends primarily on breathing difficulties causing a drop in pulmonary ventilation.

Other conditions being equal pulmonary ventilation is determined by the rate and depth of respiratory motions. At 20,000 m and higher altitudes the rate of respiratory motions grows by the average of four to five per minute

when ordinary pressure suits are worn; the increase is only two to three per minute with improved pressure suits. Consequently, high values of pulmonary ventilation observed when improved pressure suits are worn may not be attributed to the acceleration in respiratory motion rate.

The results of taking measurements of the chest perimeter while staying at high altitudes in ordinary and improved pressure suits furnish an idea as to the changes in the depth of respiratory motions. It was found that in nine out of ten cases the perimeter grew at 20,000 m altitude as compared to the original value. Yet a slight increase in the perimeter when wearing improved pressure suits was accompanied by its considerable changes in regard to respiratory phases. Respiratory motion range was similar to, or broader than, the original values. A different picture was observed when wearing ordinary pressure suits. Upon increasing during inhalation, the chest perimeter decreased but slightly upon exhalation, and the range of respiratory motions was insignificant. Consequently, with pressure breathing at high altitudes and wearing ordinary pressure suits testees showed a curtailment of the thorax excursion alongside the breathing rate acceleration. A substantially larger excursion and a slight breathing rate acceleration were observed when wearing improved pressure suits. The data thus obtained permit the assumption that the greater pulmonary ventilation values when wearing improved pressure suits depends not as much on the respiratory motion acceleration than on the deepening of breathing. This latter circumstance has its explanation in the better compensation properties of modernized pressure suits, one of which is the provision for the less encumbered thorax excursion. A confirmation thereof is found in the measurement data relevant to the values of pressure exercise against the body by both ordinary and improved pressure suits at high altitudes.

The pressure exercised by a pressure suit is not uniform against various portions of the body -- it is considerably higher in the lower chest portion than it is in the middle one. The lack in uniformity of pressure created by the pressure suit against the body is one of the design shortcomings inherent in today's pressure suits. The fact that the counterpressure against the body increases upon inhalation and decreases upon exhalation because of the capstan system regidity, while unencombered breathing calls for reverse body pressure relations according to respiration phases, is another defect of suit design.

In improved pressure suits body pressure variations

according to respiration phases are less pronounced. Furthermore the counterpressure during the exhalation phase is considerably greater than when wearing ordinary pressure suits. All this substantially facilitates the breathing and, hence, creates better blood oxygenation conditions. More favorable blood circulation conditions are also created at the same time. Yet this problem necessitates further study.

# The Influence of Rarefaction of the Atmosphere on the Chromatic Sensitivity of Persons with Different States of Color Vision

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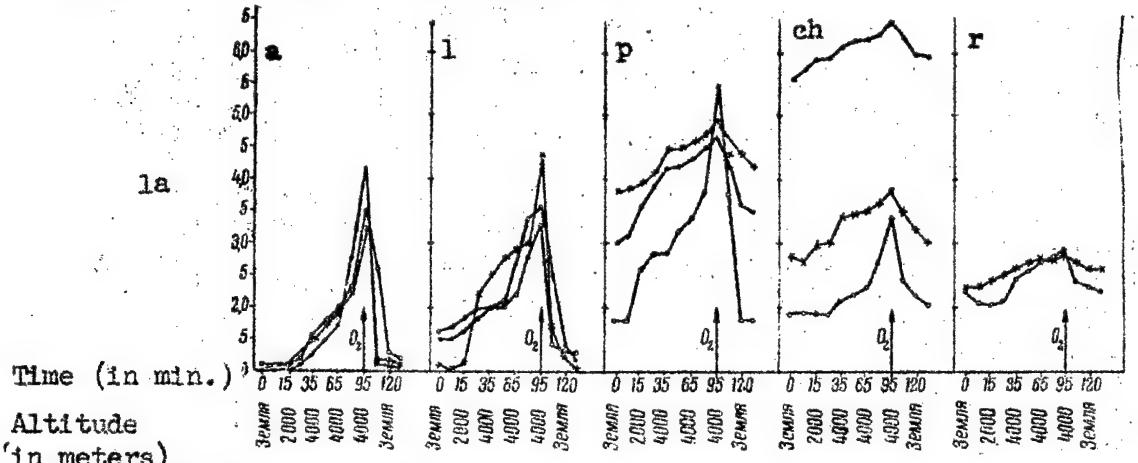
The change in color vision from the effect of anoxia has been noted by many authors. N. A. Vishevskiy and B. A. Tsyrlin observed a reduction in the power of discriminating color signals in a pressure chamber in a person with normal trichromasia beginning with an altitude of 1500 meters. The increase in the thresholds of color perception during ascents in the pressure chamber has been observed also by other authors, and L. I. Mkrtyeheva and V. G. Samsonova, in determining the threshold for color vision at altitudes of 5000-6000 meters noted a decrease in the sensitivity to green and blue colors and an increase in the sensitivity to red and yellow. The data presented concern persons with normal color vision. In the literature there is no information concerning the influence of rarefaction of the atmosphere on the color sensitivity depending on the state of the color vision of the subjects. At the same time, the study of the problem along this line is of definite interest in connection with the fact that at the present time the possibility of permitting persons to carry out flight work who have a certain degree of color blindness (according to the Rele method) which does not interfere with the perception of the air navigation color signals under ground conditions.

The study of the effect of rarefaction of the atmosphere on the color vision of the subjects was carried out in the pressure chamber. A change in the threshold excitability of various color-differentiating systems as well as in the ability to construct the Rele equation was determined by means of the GOI [State Opitcal Institute] anomaloscope of the G. N. Rautian type. Treatment of the data amounted to a calculation of the average value of the sensitivity threshold of various color-differentiation systems obtained as the result of five or six measurements and the determination of the relationship to the original thresholds of subsequent thresholds noted in normal trichromats in the ascent to an "altitide." The changes in the construction of Rele's color equation were determined by the ration of the quantity of red light to green light needed for obtaining yellow in the mixture.

We investigated eight persons with different states of color vision; of these, two persons had normal trichro-

masia; two, anomalous trichromasia; two, a color weakness; and two, dichromasia. (The diagnosis of the state of color vision of the subjects had been made in accordance with the classification proposed by G. N. Rautian).

On the Figure the results are presented of investigations depending on the state of color vision subjects. Along the abscissa axis are given the altitude of the "ascent" in meters and the time which had elapsed from the beginning of the "ascent" in minutes; along the ordinate axis, the threshold of color discrimination in multiples of the thresholds noted in persons with normal trichromasia before the "ascent". In the parentheses is indicated the condition of the color vision determined by means of the polychromatic tables of Ye. B. Rabkin.




a. Normal trichromasia
l. Anamalous Trichromasia Deuteranomaly "C"
p. Color weak anomaly (Deuteranopia)
ch. Color Weak anemaly (Deuteranomaly "A")
r. Dichromasia (Deuteranopia)
la. Magnitude of threshold of color discrimination

Key: x-x-x system I of color receptors (red); •-•-• II (green); o-o-o (blue)

Change in the Sensitivity Thresholds of Varios Color-Differentiating Systems Under the Influence of Rarefaction of the Atmosphere in Persons With Various States of Color Vision.

As seen, the color threshold of all the subjects decreased under the influence of the rarefaction of the atmosphere according to the altitude of the ascent and the time of being at a given altitude. Thereby, the depression of color sensitivity began, as a rule, with a rarefaction corresponding to 2000 meters. The maximum value of the thres-

hold of color discrimination was noted in the 60th minute after being at a rarefaction corresponding to an altitude of 4000 meters.

The inhalation of oxygen for 10 minutes notably increased the color sensitivity in all the subjects. and "descent", which took seven to 10 minutes, led to the recovery of the color discriminating function; however, it did not return to the original level in all cases. The latter was more pronounced in persons with a weakened function various systems of color receptors.

Notable differences in the change in color sensitivity under the influence of rarefaction of the atmosphere were found depending on the condition of the color vision of the subjects. With normal trichromasia comparatively great changes were found after the effect of the factor under study in the green color-differentiation system and less, in the red. Thus, in subject A. with normal trichromasia the threshold of sensitivity of the green system of receptors at the end of the hour at an altitude of 4000 meters increased by 4.2 times, and that of the red system, by 3.4 times compared with the original values noted before the "ascent."

Changes of almost the same magnitude were found in persons who possessed an anomalous type of color vision characterized by a relatively great acuity in color discrimination (not exceeding twice the magnitude established for normal trichromats). However, the changes in the various color-differentiation systems were of a somewhat different nature than was observed in normal trichromasia. For example, in persons with deuteroanomalies the red and green color-receptor systems underwent less change from the effect of rarefaction of the atmosphere than did the red system. Comparison of these data with the original condition of acuity of color discrimination made it possible to show that those systems which in their original condition possess a lower threshold of sensitivity undergo greater changes with rarefaction of the atmosphere.

This characteristic of the color-discriminating function was shown more clearly in persons with color weakness. For example, in subject P. who had color weakness the sensitivity of the red system of receptors, which in the original condition was almost four times the level of the normal threshold, decreased by 30 percent at the end of the stay at an altitude of 4000 meters, while that of the blue system, which amounted to less than twice the normal threshold before the ascent, decreased by almost 200 percent. Under the influence of rarefaction of the atmosphere the green system

of receptors in subject Ch. who had color weakness (14 percent) underwent less of a change; the sensitivity threshold of this system in the original state was more than five times the level of the normal threshold. In the absence of function of various color-differentiation systems, as occurred in dichromasia (subject R.), it was impossible to observe any effect of rarefaction of the atmosphere on this system. In this case, the other two systems underwent an insignificant degree of change from this influence.

Comparison of the data obtained shows that persons with normal and abnormal trichromasia with a relatively great acuity of color-discrimination show greater color threshold changes under the influence of rarefaction of the atmosphere than persons with color weakness and dichromasia. Therefore, the degree of change in the color vision with rarefaction of the atmosphere is determined by the functional condition of the various color-differentiating systems of the human visual analyzer.

The changes of color sensitivity detected under the influence of rarefaction of the atmosphere are in agreement with the investigations of A. I. Yusfin, B. S. Frantsen and G. N. Rautian, which show that the acuity of color-discrimination in normal trichromats at an altitude suffers the more the greater it is on the "ground." The results obtained permit us to extend the conclusions of the other authors not only to normal trichromats but also to persons having abnormalities in the condition of color vision. However, the higher level of acuity of color discrimination in persons with normal trichromasia and with the type "C" anomaly according to Rabkin's scale provides them with a relatively greater functional level of color perception under conditions of atmospheric rarefaction than that of persons who possess a weakening of this function of the visual analyzer. The data obtained, in addition, strengthen the standpoint that color vision diagnosed as type "C: anomaly of trichromasia by means of Ye. B. Rabkin's polychromatic tables is a variant of normal trichromasia, which does not present any obstacle to flight work associated with the need for discriminating color signals.

It should be noted that the ability to fill in the Rele equation under the influence of atmospheric rarefaction was not notably changed in any of the subjects and with normal trichromasia was expressed only in an expansion of the color arrangement. What has been stated indicates that the quality of human color vision for practical purposes is determined not so much by differences in the construction of the color equation as by the absolute level of sensitivity

of the various color-differentiating systems.

## Conclusions

1. The sensitivity of various color-differentiating systems under conditions of atmospheric rarefaction is decreased in accordance with the altitude of the ascent and the time of stay at this altitude.

2. The acuity of color discrimination in normal and anomalous trichromasia of the "C" type, according to Rabkin's system, is maintained at a higher level, despite a definite change in the sensitivity of the color receptors under the influence of atmospheric rarefaction, than is observed in the color weak anomaly and in dichromasia.

3. The absence of differences in the functional state of color vision between persons with normal trichromasia and those with anomalies, who possess a high degree of color discrimination acuity under the influence of anoxia, confirms the principle of permitting persons to fly who are diagnosed anomalous type "C" trichromats by means of the polychromatic tables.

# Certain Problems of Aviation Medicine Abroad

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Flying modern planes heavily taxes the human organism. Flights in the stratosphere at supersonic speeds have become impossible without using special protective equipment against unfavorable flight factors and survival equipment for emergency situations. Inasmuch as the development and improvement of flight personnel protective and survival equipment on flights are closely associated with the medical problems of providing for flight safety, research in the field of aviation and space medicine abroad is receiving serious attention, and its scope is continuously expanding. This is attested to by the following meetings in 1958: the Annual Meeting of Aeronautical Association, at Washington, in March;* the First International (the Third European) Aeronautical Congress, at Louvain, Belgium, in September;** and the Aeronautical Symposium, dedicated to the twenty-fifth anniversary of the British Interplanetary Society, at London, in October.***

At the Washington meeting, reports were discussed on these basic trends: study of decompression effect -- barometric pressure changes -- on the organism; the effect of ambient temperature factors; development of means assuring flight safety at various altitudes; flight personnel selection; etc.

Many papers indicate the necessity for development and application of remote telemetering examination methods concerning functional systems of the organism under actual flight conditions. Berr, Standart, and Voos**** showed that radio transmission and electrical recording of physiological reactions made it possible to observe the condition of flight crews directly during stratosphere flights. This applies to balloon ascents to 30,000 m altitude and aircraft stratosphere flights. As a result of research, it has been established that on stratosphere flights individual testees attained the pulse rate as high as 165-180 beats per minute, and respiration rate up to 60 a minute. The electrocardiogram revealed

* Journal of Aviation Medicine, May 1958, Vol 29, No 5, pages 397-405.

** Rivista di Medicina Aeronautica (Rome), Vol 21 (1958), No 4, pages 801-814.

*** Aviation Magazine (Paris), No 262, pages 19-21.

**** Russian transliteration wherever it was impossible to get correct spelling from reference sources.

in a number of instances changes indicating moderate hypoxia, although blood and urine analysis proved in most cases normal. The writers state that changes in physiological reactions of the organism prior to the beginning of takeoff, i.e., during the pre-takeoff period, were of particular interest. Archibald and Simons, in their paper read at the First International Aeromedical Congress, also stressed the necessity of studying physiological reactions of the organism in flight and creating the desired conditions in sealed cabins. The authors dwelt particularly on "Menkhay-P" [Man High-P?] operation, involving a balloon ascent to 31,000 m altitude in August 1957. The ascent demonstrated a practical possibility of employment of modern type sealed cabins for space flight purposes.

Papers in which authors elaborate on altitude flight oxygen supply problems are of great interest. Barron, Collier and Cook, in their report, presented data of medical observations concerning 127 testees, who were subjected to decompression in the pressure chamber from 2400 to 9700 m within 12 seconds. League, Bryant, and Powell conducted analogous investigations where testees were subjected to rapid decompression from 2440 to 12,200 m altitude within 2.5 seconds. These values correspond to the conditions likely to arise upon depressurization of high-altitude transport plane (window blow-out). In tests, at the decompression moment, record of time needed to put on and properly adjust the oxygen mask was taken. Tests revealed the need for appropriate physiological instructions prior to flight and for development of an improved oxygen breathing apparatus.

Miller and MacDonald pointed out that the Military Air Transport Service had recommended to all crew members to breathe pure oxygen for 15 minutes before boarding the plane, so as to preclude hypoxia and prevent poisoning by harmful gases on C-118 plane. However, carrying out this measure encounters certain difficulties, basically due to the design shortcomings inherent in oxygen equipment. The authors established that the oxygen mask never could fully meet individual requirements, particularly because of inconvenience caused by its long wearing.

Blum in his paper recommended an oxygen mask attachment construction where it could be easily put on with a minimum expenditure of effort and immediate maximum supply of oxygen to the organism. The author suggested a number of designs of oxygen mask attachment that have good theoretical bases, as well as a few designs tested in practice.

This question also mobilized a great deal of attention at the First International [Aeromedical] Congress. Banks and Brown dwelt in their papers on the problem of oxygen supply

to passengers and crews on Boeing-707 jet transport planes. These planes provide for the employment of oxygen masks, falling onto passengers' faces upon cabin depressurization. Analysis of data yielded by bomber aviation demonstrated that sealed cabin depressurization at more than 10,000 m altitude produces loss of consciousness, so fast that the passenger can hardly be expected to use the mask properly. The authors recommend, therefore, that one crew member wear a mask and breathe pure oxygen throughout the entire flight, so that he could assure emergency descent to 4270 m altitude. Hospodar, Czechoslovakia, noted that the aggregate sealed space volume on TU-104A plane, plying aerial routes in Czechoslovakia, measures 205 cu. m. Therefore, there is no reason to anticipate serious after-effects to passengers on this plane upon eventual explosive decompression.

The physiological effect of hyperventilation and hypocapnia upon the organism has been receiving intense study in recent years abroad. Everybody knows that respiratory alkalosis occurs in hyperventilation due to the washing out of carbon dioxide. Hypoxic symptoms can occur in such cases, since in hypocapnia oxihemoglobin, even when present in large quantities, cannot give off its oxygen to the tissues. The role of hyperventilation and its practical significance for aviation were touched upon in Malet's, Iseman's, Brent's, Scott's, Frank's, and other reports.

Several papers dealt with new methodological research procedures in the field of aviation medicine. Appleman suggested a mechanical model of lungs for study of physiological respiration mechanics. The author claims that the model, in its structural and functional characteristics, is analogous with man's respiratory system. "The thorax" is represented by a cylinder with a moving piston and a flat lid and a hose for escaping air. "The pleura" is represented by two elastic balloons inserted into one another. Pliable elastic tubes with hydraulic systems represent the vascular system.

The role of altitude chamber as a method of diagnosis of a special pathology was explained in Berry and King's paper. The authors stressed that altitude chamber examination at the present is for an aviation doctor a diagnostic method equivalent to electrocardiography, electroencephalography, and other laboratory examination methods. Using numerous examples, the authors demonstrated the actual significance of this diagnostic method and recommended carrying out on a larger scale altitude chamber examinations in conjunction with X-ray and electrophysiological methods.

Paper by Marchbanks, who himself, as medical observer,

took part in flight during the Long Legs operation, provoked a great deal of interest. Long Legs operation refers to a nonstop flight of six B-52's over the route Florida-Argentina-New York, which was carried out in November 1957. The planes covered the distance of 20,000 km in 22 hours and 30 minutes. The author examined the content of 17-hydroxycorticosteroids in crew members and detected a higher activity of suprarenal glands in persons who were emotionally excited. In the author's opinion, the study of the quantitative content of 17-hydroxycorticosteroids in flight personnel urine may serve as a reliable indication of the flight stress extent.

Glantz and Stembridge noted the etiological role of hypoxia, decompression, and stress as factors in the pathogenesis of coronary artery ailments. This is caused by the fact that coronary sclerosis of varying intensity was discovered quite unexpectedly, upon autopsy of flight accident victims, in young persons who never in their life showed any clinical symptoms of such ailment. The authors believe that these data prove the necessity for further efforts to find better methods of diagnosing coronary sclerosis devoid of any symptoms.

In reporting on the current flight personnel selection, Barvell and Cells analyzed selection data covering flight schools in the United States, Canada, Great Britain, and France. The authors pointed out that, despite the introduction of high-powered jet planes as regular armament of Air Forces in recent years, no striking changes had taken place in the flight personnel selection methods after World War II.

The Washington Congress and the First International Congress dealt extensively with the space flight medical problems. Those who read papers on the subject (Beiemer, Clark, Geratewohl and Stollings, Hawkins and others) stressed that, before sending a man into space, one must develop and test appropriate devices that would provide for his safe return; protect him against the effect of cosmic, ultraviolet, and X-rays; insure normal respiratory function and certain temperature factors; etc. These protective devices can assume the shape of a space suit, a space capsule, a space ship, or a combination of all. The development of protective devices must be accomplished in close cooperation among engineers and aviation surgeons. The performance of any protective device will be evaluated only after the astronaut returns safely from his trip.

Considerable interest was generated by Sam, Patten, and other authors' papers read at the World Congress in Belgium, because the authors had employed the encephalographic method for analysis of flight accidents. The record was taken

during combat sorties under difficult flight conditions, using for that purpose an 8-transistor electroencephalograph, which was modified and mounted aboard T-33. The unit operated reliably during temperature and pressure changes. Acceleration up to eight g and loops during the execution of acrobatic figures did not affect device operations. The authors demonstrated KEG curves of a testee-pilot. During the execution of acrobatic figures, KEG showed substantial changes, going as far as the appearance of slow oscillations. These data prove that the KEG method may be used successfully for analysis of disorder mechanics during physiological reactions of the organism when flying modern jet planes.

MacNutt showed a color film demonstrating the use of Martin-Baker ejection seat for bailout. The film shows physical factors in effect with such a bailout method; the speed of passing through the layer of water of the order of 10-10.7 m/sec., braking, airstream pressure, etc. The importance of a timely inflation of the survival vest was shown.

Aviation surgeons from the United States, Holland, and Sweden were also invited to attend the aeronautical symposium in London. For two days space flight medical problems were under discussion, specifically: the effect of mechanical forces upon the organism; "man-machine" systems; conditions inside the interplanetary ship; and some theoretical problems.

Guignard, of the Aeromedical Institute of Farnborough, pointed out that the problem of protecting men on interplanetary flights against the effect of mechanical forces would not encounter difficulties, since man with special equipment can tolerate acceleration over 10 g for several seconds, and up to 40 g for a fraction of a second. The problem of weightlessness is currently the one least examined. This is due to the fact that weightlessness is very hard to reproduce under laboratory conditions. One minute of time was the longest period of time weightlessness could be produced experimentally. The author remarked that data yielded by animals still could not furnish exhaustive answer to the question regarding the nature of changes in human psychic behavior upon a prolonged stay under space conditions.

Cunningham, British Air Fleet Ministry representative, dwelt in his paper on Professor Hobb's research. In Professor Hobb's tests, people were placed in a small sound-proof chamber. As they wore dark glasses and special gloves, the testees were practically deprived of visual and tactile sensations. As early as by the third and fourth day, nine persons out of ten requested their release from the chamber, and

only one person lasted through the seven-day test. Clinical examination revealed mental disorders and hallucinations in some testees. While reporting on tests, Cunningham, however, made this conclusion -- he is of the opinion that "psychic stress" experienced during tests is mainly due to inactivity; in contrast to that, astronauts will be kept in active state on interplanetary trip.

Parkes and Smitt's paper, dealing with the possibility of taking an interplanetary trip while in the state of "hibernation" provoked great interest. It was believed until recently that irreversible death ensued as a result of breathing and cardiac activity cessation when body temperature drops to 15° C. However, only quite recently it became possible to prove, in tests on rats, white mice, and dogs, the possibility of resuscitation of animals whose body temperature had been lowered to 0° C for one hour or longer. Similar tests on humans involve a great deal of risk and call for exhibition of boldness. Lowering human body temperature to 28° C could only be achieved in certain surgical operations. While working on this problem, one must examine thoroughly how essential will be saving in oxygen and other vital reserves if man remains in the state of "hibernation" on interplanetary trip. Man's remaining in the state of "hibernation" entails another drawback -- the astronaut will be unable to see great and fascinating phenomena encountered in the space flight. Data presented in this survey are but a part of research currently conducted abroad in the realm of aviation and space medicine. The extent of interest in these problems is associated with the tempestuous development of aviation, and the continuously growing flight altitude, speed, and range.

# The Diagnosis and Military Medical Board Evaluation of the Sequelae of Closed Cerebral Traumata

V. S. Lobzin, Major of the Medical Service,
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The diagnosis and military medical board evaluation of closed cerebral traumata are of great practical importance both in peacetime and war time.

For the purpose of solving the problem of the diagnosis, treatment and medical board evaluation of closed cerebral traumata it is important to determine the type and degree of severity of the trauma. The determination of the degree of concussion or contusion of the brain is facilitated considerably when a document is available concerning the trauma in which are reflected not only the circumstances of the trauma but also the duration of loss of consciousness, existence of vomiting, state of the pulse, blood pressure, respiration, etc. It is much more complex to make a medical board evaluation of trauma which has not been confirmed by documentation, particularly if there is no focal neurological symptomatology or if it is weak. In such cases a properly taken history is of importance.

It is known that the vegetative-vascular innervation is most vulnerable in cerebral traumata. Therefore, disturbances of it should be given great medical board-diagnostic significance in the sequelae of closed cerebral trauma.

Most often, the patients complain of headache, dizziness, increased tendency toward perspiration as well as intolerance of heat, noise and stuffiness. The latter signs are exceedingly characteristic and at times remain for a long time in persons who have had cerebral trauma.

For the purpose of evaluating the degree of trauma in the past one should not limit oneself to information only concerning the duration of loss of consciousness. The patient should be questioned in detail concerning the circumstances of the trauma, and it should be determined if he remembers them or knows them from witnesses. Whether or not he had amnesia should be clarified. It is known that in mild degrees of concussion there is no amnesia. An evaluation of the degree of closed brain trauma should be accomplished according to the conglomeration of the signs rather than according to a single sign. It is known, for example, that during the Second World War cerebral concussion occurred without loss of consciousness in 10 percent (A. V. Triumfov). Short periods of bed rest and of being in the hospital cannot always be indices of mild trauma. Therefore, it is useful

to collect information concerning the state of well being in the patients after discharge, and of their working capacity after the trauma. It is specifically in cases where there are persistent complaints of not feeling good that one needs to be on guard for complications of cerebral trauma.

Physicians of persons who have suffered trauma but who have not been treated for this should be even more on guard. Among 17 patients who had been treated previously at home, on an outpatient basis, or not treated at all we found, on examination, persons with such serious complications as traumatic epilepsy, arachnoiditis or hydrocephalus. Of 20 patients who had suffered from mild but repeated concussions only two were adjudged suitable for service, and various complications were found in 18 which excluded the possibility of carrying out service duties.

A single clinical-neurological examination did not always give us the basis for an accurate and definitive diagnosis and medical board evaluation. Without an examination of the optic fundus, roentgenography of the skull and spinal tap the medical board conclusion in a number of cases is worthless.

Of 225 patients we found various changes in the optic fundus and in the spinal fluid in 127 which made it possible for us to clarify the diagnosis and make a better medical board decision. Pleocytosis was found in the spinal fluid in 48 patients, which gave additional grounds for the recognition of traumatic arachnoiditis. Various changes in the optic fundus (from dilatation of the retinal veins to papilledema) were found in 30 patients, and an increase in the spinal fluid pressure was found in 69 by spinal tap.

Sometimes, in the presence of complaints of stubborn and prolonged headaches and a poor feeling of well being the neurological examination does not show many signs, and no changes are present on examination of the spinal fluid and optic fundus. In such cases, recourse should be had to more complex diagnostic methods.

Patient A., born 1930, was admitted to the hospital 7 January 1955 with complaints of stubborn headaches, irritability, poor sleep, decrease in memory and in the ability to work.

In 1949, during athletic competitions he sustained a contusion of the head. He was unconscious for several hours. He was treated in the hospital for a month. He was discharged in satisfactory condition; however, he was frequently troubled with headaches, and he stammered for three months. He continued to work as a chauffeur. He used

alcohol periodically. In September 1950 he was called up for military service and sent into the navy. Beginning with 1951 he served as a machinist in the bilge of a ship. From this time on his headaches increased and became constant. He tolerated heat and noise poorly, and his feeling of well being deteriorated when he looked at moving pictures. His memory became worse, and his working capacity decreased. In connection with this, he was transferred to shore service in 1954. Beginning with the end of 1954 his feeling of well being deteriorated even more, and he was unable to manage service duties.

On neurological examination a definite emotional and vegetative lability was found, insignificant weakening of convergence on the left, insignificant deviation of the tongue to the right, absence of the abdominal reflexes. On survey roentgenograms of the skull and on examination of the optic fundus and spinal fluid no pathological changes were found. Treatment, which was given for three months, was unsuccessful. The headaches remained intense, and periodically increased to the point that the patient, in his own words, could not find where to put himself. On 30 March 1955 a pneumoencephalography was performed for diagnostic and therapeutic purposes, after which the patient noted a considerable improvement. On the encephalograms there was an absence of pneumatization of the right lateral ventricle (as a result of cicatricial changes in the brain tissue), and a very considerable enlargement of the left lateral ventricle. The anterior horn of the left ventricle resembled a hen's egg in size and shape. The following diagnosis was made: persistent residual signs of contusion and internal hydrocephalus of the brain. He was considered unsuitable and was taken off the records.

Through using pneumoencephalography, and afterwards (beginning with 1956) oxygenoencephalography, we obtained not only a diagnostic but also a therapeutic effect in the majority of cases. To be sure, we were cautious in resorting to such a serious manipulation as pneumoencephalography, that is, it was performed only in the presence of strict indications.

From the material which we studied on 225 patients a diagnosis of concussion was made in 136; contusion of the brain, in 89. In cerebral concussion, as a rule, complete clinical recovery occurred. The suitability category was changed in only 11 patients of whom 9 were considered unsuited to military service in peace time (in five patients a diagnosis was made of hydrocephalus and arachnoiditis; in four, signs of definite emotional and vegetative instability)

Two were considered unsuitable for service in the navy on account of vestibular-vegetative instability. In 75 patients with cerebral contusions the suitability category was changed (in 54 of them hydrocephalus and arachnoiditis were found). A furlough because of sequelae of cerebral trauma can be given, in our opinion, only in exceptional cases, where there is indisputable confidence in rapid and complete recovery. It goes without saying that the necessary therapeutic measures under domestic conditions cannot be carried out so completely and consistently as in a medical installation.

In solving medical board problems it should also be kept in mind that even in cases of cerebral concussion of moderate severity the complete disappearance of the symptoms occurs no earlier than four to six months after the trauma; however, under the influence of overfatigue, infection or use of alcohol the condition not uncommonly deteriorates again.

In persons with sequelae of cerebral trauma the syndrome of post-concussion arterial hypertension was not uncommonly encountered. In certain of these patients the therapeutic effect was obtained only after decompression spinal taps, which once again indicated the traumatic origin of the arterial hypertension.

In the solution of medical board problems with respect to persons who have had closed brain traumata in the past the decision should be based on the use of all possible diagnostic methods.

## Errors in the Military Medical Board Decisionsof ENT Issues

Docent M. I. Svetlakov, Colonel of the Medical Service

Participation of otolaryngologists in the work of military medical boards consists in the determination of suitability of those called up for military service with respect to the conditions of the ear and upper respiratory passages and in the indication of the possibility of using them in various kinds and units of troops. Of the ENT diseases in the draftees, ear diseases are encountered most often. According to the data of the military medical boards and the pathology service during the Second World War, chronic purulent diseases of the ear with a serious course, not recognized in time and involving intracranial complications and sometimes with a fatal outcome, were encountered in a considerable number of ENT patients; this was brought about by the inadequate sifting of persons with early pathology at the time of being taken into the army.

To date there are cases where persons with diseases of the ear, nose and throat which interfere with military service are being drafted into the army.

We have analyzed the errors committed by the military medical ENT board of the military medical boards. The errors in board evaluation occur as a result of the most varied reasons. Inadequately thorough and inadequately qualified examination of draftees by otolaryngologists leads to the admission of persons into the army who are clearly unsuitable for military service. As a result of this, patients with chronic suppurative epitympanitis, chronic purulent complicated otitis media, permanent reduction in hearing and a high degree of stammering are found in the units.

Private B., born 1937, complained of a constant discharge of pus from his ears, reduction in hearing in both ears, ringing in the ears and head, and headache. The disease of the ears had begun after some childhood disease. Outpatient and hospital therapy with various measures given before the patient was drafted proved to be ineffective. On otoscopy a copious mucopurulent discharge from the tympanic cavity with an unpleasant odor was found in the auditory canals; both tympanic membranes had large circular perforations in their central portions with calcified edges through which the pink mucosa of the tympanic cavity could be clearly distinguished. Whispered speech could be perceived by the right ear at a distance of two meters; by the left, from three meters. A corresponding reduction in auditory acuity was found on tuning fork examination. Diagnosis: chronic purulent bilateral otitis media. He was

discharged with the following decision: unsuitable for military service in peace time; suitable for noncombat service in the rear in war time.

Draftees with such chronic ear diseases who had been sent to service in special kinds of troops, including the navy, were sent back to the rayon military commissariats. Sometimes, the characteristic features of being in the Arctic were not taken into consideration in distribution. Not uncommonly, the draftees were dropped out of units of special branches of the army because of their hearing, although they were fully able to carry out service in ordinary units, and after a reexamination the military commissariat returned them to the army. This is the result of the fact that in selection of the draftees the characteristics of service in special branches of the army were not taken into consideration.

In the draftees with permanent residual signs following otitis in the form of cicatricial changes of the tympanic membrane, who are suitable for service in the units according to the table of diseases in effect, ear diseases sometimes occur under conditions of marching and camp life which require treatment. However, instead of this they are discharged from the army.

Private B., born 1935, was considered suitable for combat duty by a decision of the board dated 23 August 1956. During his trip to the unit he became ill with influenza complicated by disease of the right ear, from which he had had a purulent discharge in the past. On his arrival at the military unit 1 December traces of pus in the auditory canal and a scarred anteroinferior quadrant of the tympanic membrane could be found. Whispered speech was perceived by right ear only at the aural concha; by the left, from a distance of five meters.

As a result of the erroneous diagnosis (chronic right-sided otitis media), B. was discharged from the army 4 January 1957 although all the data indicated that he had had an acute purulent inflammation of the right middle ear against the background of a cicatricial change in the tympanic membrane.

Draftees with chronic disease of the ear are sent to the units chiefly during the period of quiescence of the process. On exacerbation of the process during the first few months of service such patients are discharged from the army, thereby increasing the number of persons unsuited for military service. However, after they return to the place where they live and as a result of treatment, and sometimes without it, the process in the ear becomes quiescent, and

they become suitable again for military service. Therefore, either undertreated purulent inflammation of the middle ear or the lack of rendering medical measures for the upper respiratory passages and oral cavity contribute to ear disease. Hence, it follows that treatment and prophylaxis of ENT diseases in draftees are not sufficiently well organized. Sanitation education work is not always carried out among the draftees, as a result of which many of them do not seek medical care or do not consent to operations. The regional otolaryngologists are still being called in rarely for consultations. Many otolaryngologists at the time of routine examinations take inadequate account of the data of the history, and inaccurately formulate the diagnosis of various forms of chronic purulent otitis media. Not uncommonly, the diagnosis is encountered on the record cards of the draftees -- "chronic otitis," which considerably complicates making a proper medical board decision.

In the practice of the military medical ENT board the individual approach is sometimes incorrectly used to the evaluation of the degree of suitability for military service. The errors committed are based on an inadequate consideration of the requirements made in various branches of the army during military service. For example, persons with changes in the ear in the form of the initial form of otosclerosis should not be taken into the army even when they have comparatively good hearing, because from the point of view of possible dynamics of the process a deterioration of the hearing is to be expected. In exactly the same way draftees with definite atrophic rhinopharyngitis should not be sent into tank units. The individual approach is needed also in the evaluation of stammering; however, errors are committed in practice in the establishment of the degree of speech disturbance. The medical board decision is not always made here on the basis of a consultation between the neuropathologist, psychiatrist and otolaryngologist.

The errors of otolaryngologists participating in the military medical boards depend also on the inadequate study of the legislation and an inadequate knowledge of the rights and duties of physicians working on the boards.

Problems with which the military medical board is confronted can be solved successfully only if all the specialists participating in the work of the boards master the basic requirements of military medical board evaluation, the standards and methods of examination of the ENT organs.

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## Method of Excluding Hearing for Medical Board Evaluation

S. Ye. Parnenko, Lieutenant Colonel of the Medical Service

In order to exclude the ear from the act of hearing there are many methods in existence. It has been suggested that the ear be stopped up with the finger, cotton, a rubber tube, that a stoppered ear funnel be introduced into the ear, or that the Barany rattles be used. The trouble with using the Barany rattles for blocking one ear is that it partly blocks the other ear also (V. I. Voyachek. "Voynnaya otolaringologiya" [Military Otolaryngology], 1946, page 319). The other methods do not completely exclude the ear from the act of hearing. In addition, closure of the canal alone cannot completely deafen the ear, because the act of hearing is brought about by the passage of sound through the tissues surrounding the auditory canal, not just through the air.

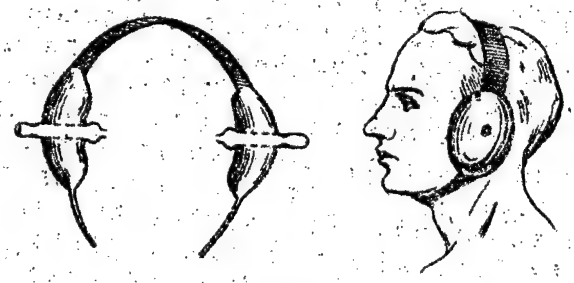

Fig. 1

Complete exclusion of the ear from the act of hearing is particularly important in medical board evaluation. For this purpose we have designed an apparatus of the head dressing type made of two antinoise bags filled with a sound-deadening mass suggested by V. I. Voyachek (Ibid., page 63, 64). A metal tube with its ends projecting from the inside and outside surfaces of the bag passes through the center of each antinoise bag (Fig. 1). The inner olive-shaped end of this tube with a rubber tube applied to it is designed for stopping up the auditory canal, while the outer end is for closure by the subject's finger. The tube of one bag is designed for double sound conduction -- through the continuous central opening and the side openings made in the tube, while the tube of the other bag, which in external appearance is similar to the tube of the first bag, is tightly stoppered from within (Fig. 2).

During the examination the apparatus is applied to the head in such a way that the bag with the sealed tube is placed over the ear with good function, while the bag

with the open tube is placed over the "deaf" ear. After the subject has been told to close the opening of the tube coming from the bag over the "deaf" ear with his finger, test words are given as though with the aim of checking the auditory function of the good ear (which is closed by the sealed tube). If the subject repeats the words the existence of hearing in the "deaf" ear is shown. Then the subject is told to cover the tube of the bag over the good ear and is given the words again. If in this case the subject cannot repeat the words, which in the first test he could have heard only with the "deaf" ear, this serves as further confirmation of the feigning already established.

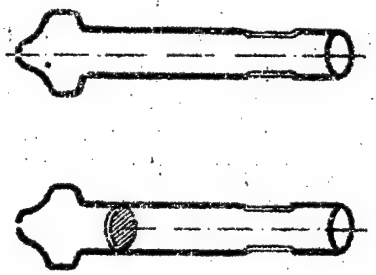

Fig. 2

Aside from its main board evaluation function, we have used the apparatus described successfully also with the aim of ruling out dissimulation. A subject who desires to conceal an existing unilateral deafness from the physician incompletely closes the ear opposite to the affected one. In order to eliminate this, the work is done with an assistant who covers the subject's ear. The apparatus which we have proposed makes it possible to do without an assistant and to eliminate the possibility of dissimulation by the subject, for which the bag with the stoppered tube is transferred from one ear to the other. For the purpose of convenience in work we have set up an apparatus of the earphones type according to the principle described, which consists of two chambers fastened to an arc-shaped elastic metal plate into which the same tubes are inserted as in the bags. Tight adaptation of the chambers to the area of the ear conchas is achieved by sponge rubber at the free edges.

## Principles of Military Medical Board Evaluation in Closed Forms of Pulmonary Tuberculosis

Docent V. A. Vasil'yev, Lieutenant Colonel of the Medical Service

The examination which is carried out for purposes of determining suitability for military service is, as is well known, carried out as early as from the time of registration at the induction station; the final decision is made at the draft board. However, taking into consideration certain clinical characteristics of tuberculosis and the diagnostic errors made at the draft boards, medical board evaluation of the health of Soviet Army personnel does not end there. Often, forms of pulmonary tuberculosis are found in the hospitals which are absolute contraindications to carrying out military service. Cases are also encountered which give difficulties and, therefore, cause errors in medical board decisions.

Three categories of medical board errors are observed in connection with patients with pulmonary tuberculosis: the inclusion of unsuitable persons in military service; discharge of those suitable for service from the military service; untimely diagnosis of active forms of pulmonary tuberculosis in the course of military service.

The difficulties sometimes observed in the medical board evaluation of closed forms of pulmonary tuberculosis are becoming more perceptible at the present time, when a tendency is being noted toward a change in the usual course of tuberculosis.

It is known that tuberculosis has always been considered a serious chronic disease, and the mortality rate from it was high in all the countries of the world. Nowadays, owing to the extensive organization of social, sanitary and specific prophylaxis, the use of new therapeutic and surgical methods of treatment, a marked reduction in the tuberculosis mortality rate has been noted everywhere. As far as the morbidity rate is concerned, it has not been reduced so considerably, and in various capitalistic countries it has even increased.

In the USSR the morbidity rate has been decreasing along with the decrease in the mortality rate. Thus, for example, in Leningrad, the number of patients with open tuberculosis who have sought medical aid for the first time has been reduced by more than 40 percent in the past five years. The changes which have occurred deal not only with the reduction in the number of tuberculosis patients and the

reduction in the mortality rate from it but also the interrelationships of various clinical forms of pulmonary tuberculosis. According to the data of the Moscow dispensaries (1956), the focal (58.5 percent) and infiltrative (25.6 percent) forms are the most frequent in the clinical structure of pulmonary tuberculosis; galloping consumption [acute disseminated] constitutes 4.9 percent and chronic disseminated tuberculosis, 11.0 percent. Favorable changes have also been noted in the course of these forms of tuberculosis, namely, a reduction in the number of patients with destructive processes. However, despite these changes there are cases being discharged from the army for pulmonary tuberculosis.

Information in the literature dealing with the prognosis of the types of focal pulmonary tuberculosis are very contradictory. In some cases mention is made of the stability of the process; in others, of activation of tuberculosis foci. Thus, for example, G. R. Rubinshteyn (1933) noted progression of an inactive tuberculous process in 25.5 percent. Tubercle bacilli were found in the sputum in 20 percent of these patients. I. Ye. Kochnova (1939), who observed persons with calcified and dense foci and fibrous changes in the lungs, determined the pulmonary outbreaks to be 5.9 percent; 84.5 percent of the subjects had stable processes, and in 9.6 percent a regression of it was found. Some authors (I. I. Berlin, 1954, and others) give a higher percentage (12.2 percent) of activity of the "minor forms" of tuberculosis.

Different diagnostic evaluations of focal tuberculosis and a clinical approach to these changes which is not always correct constitute the grounds for medical board errors. Three years ago, we summarized the results of work on the study of the causes of diagnostic errors observed at the time of drafting into the Soviet Army. Through the data of analysis of the material of the OVVK [Military District Medical Board] of certain districts and a direct study of the work of various draft boards we established the fact that among patients with tuberculosis discharged from the army 86 percent had been drafted with active pulmonary tuberculosis in a subcompensated state (15 percent of them had already had deep-seated processes; the others had compensated pulmonary tuberculosis). Of the group of those discharged 68 percent were considered unsuitable and were dropped from the records, and 32 percent were deferred until the next draft.

An analysis of the material under study permitted us to divide the causes of errors into three groups. The following made up the first group of errors: decisions about

suitability for military service made without preliminary roentgenologic examination of the chest cage (14.5 percent of those discharged); underestimation of the weakened state of the patients with compensated pulmonary tuberculosis and soft foci after a recent outbreak without signs of intoxication.

Among the errors of the second group there were errors of X-ray diagnosis, which occurred in more than a third of the drafted patients with pulmonary tuberculosis. This depended on improper methods of examination and on the erroneous evaluation of the changes encountered. The internists of the draft boards and the phthisiatrists did not always require a compulsory and good-quality roentgenoscopy of the lungs, and the conclusion "suitable" was often made without consideration of the data of this method of examination. Even in those cases which gave rise to doubt as to the proper X-ray diagnosis repeated and particularly extended methods of X-ray examination were rarely used. The cause of errors of the third group was constituted by organizational deficiencies; the principal ones were: the absence of mass thermometry and clinical laboratory examinations at the draft boards.

An analysis of the material of the hospitals from several districts made by Ye. I. Volodin in 1951-1954 confirms the data which we obtained previously concerning a certain incompleteness of the medical board evaluation of the tuberculous changes in service men with closed forms of pulmonary tuberculosis, which in 13.5 percent served as the cause for a repeated hospitalization of them with subsequent discharge from the army. In 86.5 percent a permanent compensation of pulmonary tuberculosis was correctly established, and all the soldiers discharged to their units carried out service well and completed it without any exacerbations of the disease.

Inactive tuberculosis does not, by far, always become exacerbated under army conditions. We are in agreement with the way the problem of the influence of military service on the course of closed and inactive forms of pulmonary tuberculosis is handled in the literature (V. M. Novodvorskiy): on the one hand, military service exerts a favorable influence on its course because of the strict routine, good hygienic conditions of work, life and nnutrition, regular toughening up and physical culture and constant medical supervision; on the other hand, it can also cause a deterioration in the course of the process because of different degrees of adaptability to the new conditions of climate, living and nutrition, to considerable physical exercise, particularly for

the untrained, during maneuvers, athletic competitions, and the provocative influence of prophylactic vaccinations, etc. The soldier's age, at which age the development of pulmonary tuberculosis is most often observed, is also of importance.

The chair of tuberculosis and roentgenology of the VMOLA imeni S. M. Kirov [Military Medical Order of Lenin Academy imeni S. M. Kirov] has observed a large group of soldiers for many years with compensated focal pulmonary tuberculosis, that is, a closed inactive process which does not interfere with military service. These observations made it possible to establish the fact that not all the forms of inactive pulmonary tuberculosis are inclined toward progression under army conditions. Most often, progression of tuberculosis was observed when there was a grouped arrangement of foci of different densities, localized in the subclavicular and apical-subclavicular areas. When there were soft and hard foci (the structure of the foci was revealed chiefly by tomography) an unfavorable outcome was observed in 2.4 percent of the cases, up to the point of degeneration of the foci. In this group we, as has also I. Ye. Kochnova, have observed a change in the process in the direction of resolution of it, which was noted in 4.1 percent of the cases. Progression of the process was not observed a single time in persons with calcified and dense foci. It should be emphasized particularly that we determined the nature and arrangement of the focal changes with the use of all the modern methods of roentgenologic examination, particularly with the use of spot films and laminography. When these methods of examination are not used errors often occur in the medical board evaluation of closed forms of pulmonary tuberculosis. Even greater diagnostic significance is ascribed to these methods of investigation in the presence of hard and calcified infiltrates. According to the data of our observations, the well compensated dense and calcified infiltrates remained stable for a long time.

We ran up against a very important fact, from our point of view. Patients with various manifestations of active progressive tuberculosis from the group of soldiers who were not on our records were admitted to the field hospital and clinic from units the soldiers of which were under our observation because of the diagnosis of inactive pulmonary tuberculosis. In half of the cases these changes were detected for the first time in the second year of service. The possibility has not been ruled out that in part of the soldiers a tuberculous process existed before being drafted, which could not be detected by ordinary clinical-roentgenological examination.

The data presented permit us to express certain considerations relative to improvement of the military medical board evaluation of closed inactive forms of pulmonary tuberculosis.

To date, the nature and activity of focal pulmonary tuberculosis is not being evaluated sufficiently correctly in various draft boards and field hospitals in determining suitability for military service. This is occurring because all the possibilities of modern clinical-roentgenological methods of examination are not being used. Multiaxial roentgenography, the use of survey, spot and overexposed films, and, in individual cases, also tomography make it possible to determine and evaluate tuberculous changes in the lungs more accurately. Careful taking of the history and listening to the complaints and complete physical examination and analysis of the result of laboratory examinations make it possible more completely to clarify the matter of the state of compensation of the tuberculous process and to make a better medical board decision. If, after observing all these conditions of examination, data are obtained which indicate stability of compensation in the presence of solitary or multiple disseminated calcified foci or individual dense foci or isolated calcified infiltrates the tuberculous process may be considered concluded, and the draftees for military service may be considered suitable for combat service without restriction. Subjects who have the same changes in the lungs but with a group arrangement of the foci or with foci of different densities (calcified foci and solid foci) should be subjected to tomography for clarification of the nature and activity of the process. Medical board decisions in these cases are made depending on the data obtained: a) with confirmation of only the calcified and hard foci the draftees and service men are suitable for military service (with the exception of certain branches of the army); b) with detection of soft changes among the calcified and hard foci or of perifocal changes around the various hard foci and with detection of soft foci in the lungs and of foci of different densities (soft and hard), even with stable compensation of the process, the draftees and service men are unsuitable for military service and are dropped from the records; c) persons who have calcified and hard foci in the lungs in the presence of signs of intoxication connected with the expression of this process should be considered patients with active tuberculosis and should be discharged from the army; d) service men who have hard infiltrates in the lungs the time of appearance of which it is impossible to establish or who have tuberculomas should be discharged from the army.

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# The Role of Gastroscopy in the Diagnosis and Military Medical Board Evaluation of Patients With Gastric Diseases

N. I. Bodrov, Lieutenant Colonel of the Medical Service

According to existing regulations patients with chronic gastritis may be adjudged unsuitable for service in the army only when there is a marked disturbance of the functions of the stomach and adjacent organs leading to a definite weight loss. However, among the patients with gastritis there are those in whom the functions of the organs, with the exception of the sensory function, suffer little but in whom the disease is often exacerbated and incapacitates the patients for a long time. In the majority of cases these are patients with antral, erosive, erosive-ulcerative, polypoid gastritides who are rarely diagnosed without instrument examination. Gastroscopy plays the deciding role in their diagnosis.

The clinical aspects of chronic gastritis are not uncommonly similar to those of peptic ulcer; gastroscopy is also of great importance in differentiating these diseases.

Our experience in the determination of the significance of gastroscopy for the decision of matters of military medical board evaluation of patients with gastric disease is based on the study of 98 patients who were examined with the use of all the modern methods of examination, including gastroscopy, chromogastroscopy, and determination of the gastric leucopedesis. There were 22 patients with duodenal ulcer; 10, with gastric ulcer; 53 with chronic gastritis and functional gastric disturbances; 13 with gastroduodenitis.

The medical board evaluation of patients with duodenal ulcer, in whom the disease was accurately diagnosed by clinical and roentgenologic data, offered no difficulties. However, the medical board evaluation of patients with gastric ulcer gave rise to certain difficulties. Of the 10 patients with gastric ulcer this diagnosis was confirmed by roentgenologic data in three; in four, by roentgenologic and gastroscopic methods; in one patient the diagnosis was made on the basis of the clinical aspects and history; and in two, the diagnosis was established only by gastroscopy.

Patient G., age 23, was admitted for treatment 11 March 1955 with complaints of constant aching pains in the epigastric area, which increased on a fasting stomach and one to 1.5 hours after eating. He considered himself sick since December 1953 when he first began to be troubled with heartburn and pains in the epigastric region.

On objective examination the following were found: the tongue was covered with a white coat; the temperature was normal. The heart and respiratory organs were normal. The abdomen was soft, tender in the epigastric area on the right. The gastric contents showed the following: total acidity--24-64; free hydrochloric acid--6-52. Roentgenoscopic examination 17 March: there were no signs of organic involvement of the stomach or duodenum. Gastroscopic data dated 28 March: ulcer of the anterior wall in the lower third of the stomach; diffuse hypertrophic gastritis, moderate disturbance of the excretory function.

Clinical diagnosis: peptic ulcer. After treatment the patient was examined by the military medical board, considered unsuitable for military service and was dropped from the records.

Therefore, in a number of cases even with a characteristic clinical picture of peptic ulcer difficulty may arise in making the diagnosis if an ulcer has not been confirmed roentgenologically. In such cases gastroscopy, by contributing to the elucidation of the diagnosis, aids in making the proper medical board decision with respect to these patients.

Even greater difficulties are encountered in the solution of the problem of suitability for military service in patients with chronic gastritis. Among them there are patients with erosive, erosive-ulcerative, polypoid and antral gastritides, the clinical picture and course in whom are similar to that of peptic ulcer in a number of cases. Without gastroscopic examination these forms of gastritis are rarely found; therefore, a comprehensive examination of patients with the use of gastroscopy is necessary.

In addition, among the patients with chronic gastritis there are sometimes patients with gastric ulcer in whom no ulcer is found on X-ray for various reasons. Roentgenologic confirmation of the ulcer in many cases is decisive both in making the diagnosis of peptic ulcer and in the medical board evaluation of such patients. Of 53 patients with chronic gastritis and functional gastric disorders ulcerative processes in the stomach (superficial and deep ulcers) were found on gastroscopy in three; erosions, in four; polyps, in one.

From the data presented it follows that gastroscopy is of great importance in the military medical board evaluation of patients with gastric diseases.

At the same time, the shortcomings of gastroscopy should be noted, which to a certain degree reduce its practical value. This method of examination is not well tolerated by the patients. Certain areas of the stomach are in-

accessible to examination by gastroscopy. Its use is limited by a number of contraindications which are presented in textbooks on gastroscopy. It should be used when there is a suspicion of ulcer and tumor of the stomach which has not been confirmed roentgenologically, when there is a suspicion of gastric polyposis or erosive-ulcerative gastritis, for the purposes of elucidating the causes of gastric hemorrhages, of differentiating gastritis from gastric ulcer and in other gastric diseases which present difficulties to the military medical evaluation board.

## Autografting of Skin in Patients With Thermal Burns

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M. I. Dolgina

In patients with extensive third-degree burns the burned surfaces should be covered artificially. Grafting of skin in such cases not uncommonly is a life-saving measure. Usually, it is customary to consider that autografting, in contrast to homografting, is usually successful, and the transplanted skin grafts "take" reliably. However, a favorable result occurs only after observance of a number of conditions; otherwise, the operation terminates in separation or absorption of the transplants.

In the opinion of many investigators (N. N. Blokhin, B. A. Petrov, B. N. Postnikov and others), a prerequisite for successful autografting is a sufficiently high hemoglobin and protein plasma level in the subjects. This has also been confirmed by our observations. Therefore, it may be stated that success in grafting is directly related to the efficacy of preceding therapy.

It should be noted that the method of comprehensive therapy of burn patients worked out at the Institute of Surgery imeni A. V. Vishnevskiy in many cases prevents the development of post-burn anemia and hypoproteinemia even where there are very extensive burns and, by the same token, makes it possible to perform skin grafting under more favorable conditions (A. A. Vishnevskiy, G. D. Vilyavin and others).

As great as the importance of the level of plasma proteins is for the outcome of skin grafting this problem should not be approached dogmatically. In various septic patients, despite repeated administration of preserved blood and protein plasma-substitutes, the hypoproteinemia persists stubbornly, as does also anemia of the hypochromic type. Sometimes skin grafting has to be decided on even in such patients. The experience of the Institute imeni A. V. Vishnevskiy attests to the fact that in certain patients with hypoproteinemia and anemia it is possible to obtain a "take" of the skin grafts (S. P. Protopopov, G. D. Vilyavin and others). Sometimes, the extremely serious condition of the patient does not permit the loss of time for prolonged postoperative preparation, and the skin autografting undertaken at times under very risky conditions proves to be the salvation.

Patient B., age 26, was brought to the Institute 3 October 1957 in a state of severe septicemia with third-

degree burns of 36 percent of the body surface. The burns had been sustained one and a half months previous to admission. The patient had bed-sores down to the sacral bone. At the time of admission the hemoglobin was 52 percent; the blood proteins, 16.5 grams percent. The wound microflora were the following: Streptococcus hemolyticus aureus and the Bacillus pyocyaneus. Comprehensive therapy was begun. Before the operation the patient was transfused with 250 cubic centimeters of LSB /plasma substitute/ and 225 cubic centimeters of an erythrocyte suspension.

On 10 October a skin autografting was performed. Two grafts measuring 7 x 10 and 7 x 12 centimeters and six smaller grafts were taken from the anterior abdominal wall. Part of the granulating wounds were covered with transplants. Part of the skin taken was cut into small pieces (0.3 x 0.3 centimeters) which were implanted in the depth of the granulations according to the method of S.P. Protopopov. Two days after the operation the general feeling of well being improved, and the temperature dropped. All the transplanted skin grafts took and began to grow though the concentration of blood protein was low (analysis of 31 October; Blood proteins-- 16.1 grams percent). Afterwards, (5 November) a second, more extensive autografting was undertaken. This time the grafting was also successful, although, despite the repitition of the blood transfusion and protein substitutes the blood protein fell to 13.5 grams percent ( nalysis dated 13 November)

The patient recovered; the treatment in the Institute lasted 104 days.

If grafting in patient B. had been postponed until the blood protein level becomes normal, he most probably would have died.

Skin grafting, like many other operations, sometimes has to be undertaken obligatorily, according to the indications, urgently, and under definately unfavorable conditions.

The problem of times of grafting skin is of great practical importance. We are not proponents of obligatory necrectomies which free an area for skin grafting. Such excessive surgical activity in the case of extensive burns lead to a considerable additional trauma and cannot be justified. Apparently, the best time for grafting should be considered the third and even sometimes the beginning of the forth week after the burn. At this time, the wounds are often free of necrotic tissues and are covered with granulations. For the purpose of accelerating the processes of seperation of the necrotic skin we perform a bilateral paranephric novacaine block

repeatedly on the 10th-12th day after the burn. Oil-balsam dressings regularly used for burns contribute to this. In the case of extensive deep burns we carefully make incisions and "windows" in the necrotic skin during the dressings, and we also excise, partially, the well-defined foci of necrosis, thereby accelerating sloughing off of the tissue. This kind of procedure can be accomplished readily without analgesia.

As is known, the skin is abundantly supplied with sensory nerve endings. Therefore, taking a skin graft from a weakened patient is not such an innocuous procedure. Based on the need for maximally protecting the patient's nervous system, we have been using the method of stage autografting extensively in the case of extensive burns. In such cases it is sometimes possible to take skin repeatedly from the same area or from the area of a former second-degree burn which has healed at the time of the second grafting. The young cells of these grafts possess a good regenerative capacity.

At the present time, the majority of surgeons does not reckon much with the nature of the microflora of the burn wound which is being covered. B. A. Petrov, B. N. Postnikov, I. S. Kolesnikov, T. Ya. Ar'yev and other authors note a good "take" of the grafts even when there are pathogenic microbes present in the wound. We have made similar observations.

In such cases the essence of the matter is that the infection demonstrated bacteriologically does not show any clinical manifestations and dies under the influence of biological protective mechanisms. However, it seems to us, we should not overlook the nature of the wound microflora in weakened patients. Sometimes, the presence of pathogenic microorganisms can still be related to a distinct disease of a successful skin flap which is observed. Thereby, small, slowly progressive pus pockets are formed under the transplant, and the graft undergoes partial shrinking. Therefore, when there are unsatisfactory results from the bacteriological examination, and if the patient's condition permits, it is advantageous to cleanse the granulation bed with dressings changed daily consisting of an aqueous solution of furadantin (1:5000) or solutions of antibiotics (if the microbes are sensitive to them).

In certain patients sometimes multiple hematomata are formed in the depth of the granulation tissue. From time to time such hematomata recur stubbornly. Apparently, a distinct expression of the fragility of the blood vessels occurs here because of hypovitaminosis. Skin grafting with such a pathological condition of the granulations is often doomed to failure. Scraping off the pathological granula-

tions directly before skin grafting can sometimes be of benefit to the patient, but complete hemostasis needs to be provided before the grafting, using washes of hot physiological solution, a hemostatic sponge or cotton. Intravenous injections of ascorbic acid are also of benefit in combination with dressings of carotene emulsion during the period before and after operation. If the hematomas occur after the operation recourse is had to careful evacuation of them. By this means it is often possible to preserve the viability of the grafted skin.

We are proponents of grafting skin onto granulation tissue, because, in our opinion, it improves the receptive properties of the bed.

By way of pre-operative preparation of patients with burns who need skin grafting we use the parenteral administration of protein plasma-substitutes, vitamins, increased proteins in the diet. In the case of suppurating wounds frequent baths are given with weak potassium permanganate solution. For the purpose of autografting we use the split-thickness skin graft usually 0.25-0.5 millimeters in thickness. The thickness of the skin graft is accurately regulated through the use of dermatomes of a new design. We are successfully using the very convenient electrodermatome andpneumodermatome designed by the Scientific Research Institute of Experimental Surgical Apparatus and Instruments. Excision of the skin for grafting is accomplished almost always under local anesthesia--¼ percent novocaine solution. The entire operative field is anesthetized by the "lemon peel" method of A. V. Vishnevskiy. Practice has shown that this simple and protective method assures complete analgesia during the operation.

The maximum width of the transplants is determined by the structural characteristics of the dermatomes and usually does not exceed six to seven centimeters, and the length is different depending on the size of the donor area and the dimensions of the defects being filled. Even with a satisfactory general condition of the patient the size of the donor areas should not, in our opinion, exceed 1200-1600 square centimeters. Simultaneous excision of the excessively large skin areas sometimes is poorly tolerated by weakened patients. Thin skin grafts adhere well to the granulation surface, and therefore there is no need to fix them additionally with sutures. In the case of extensive burns, when considerable surfaces need to be covered there is not enough healthy skin area suitable for taking the transplant. In such cases, the so-called "stamp method" is being used extensively for purposes of economy of grafting material; here the granulation surface is covered with small transplants

the size of postage stamps in a checkered order; or else, the method of implanting small pieces of skin into the depth of the granulations is used. After the transplants "take" they begin to grow together, and finally they cover the defect completely.

After grafting a dry gauze napkin is applied to the wound which is held by mastisol along the periphery of the wound, and then napkins with penicillin solution and Vishnevskiy ointment are applied in a tile-form fashion; a plaster splint is applied. After hemostasis the donor areas are covered with a three- or four-layered dressing: in the first layer are napkins moistened with penicillin solution (50,000 units of penicillin per 100 cubic centimeters of 0.25 percent novocaine solution), and in th second to fourth layers, napkins dipped in Vishnevskiy ointment.

In the post-operative period complete rest of the operated area is provided. The first change of dressings is usually accomplished six to eight days after the operation. After removing the upper layers of the dressing the patient is placed in a bath with a warm weak solution of potassium permanganate until the lower layers of the dressing come off from the soaking. The dressings covering the donor areas sometimes do not come off from the soaking. In such cases, we leave the lowermost layer of gauze on the wound and simply wet it copiously with Vishnevskiy ointment. On the eighth to twelfth day, the epithelialization of the donor area is usually complete.

In cases of skin grafting on exposed tendons and over joints (particularly on the hands) necrosis of the skin grafts is sometimes observed. Recently, we have not been using all the skin taken for such grafting, and we keep it on reserve in Petri dishes in an ordinary refrigerator. If we find necrosis of the grafts at the time of the first redressing, we have ready material for immediately repeated grafting. If there is no necrosis we transplant this skin there and then to other areas or use it for homografting. The first observations have shown the complete viability of skin preserved in the cold.

With attentive observation of the operated patients the outcome of the skin grafting usually can be predicted even before revision of the wound. In the event of complete success of the operation, a definite improvement in the course of the disease can be noted most often as early as two or three days after the grafting; the fever is reduced, appetite is regained, insomnia disappears, and the complaints of unpleasant sensations in the wound disappear; the dressings remain dry, even where the entire surface of the granulations has not been covered with the grafts.

With failure of the operation the condition of the operated patients continues to be serious, and the skin grafting does not give the anticipated effect. At the time of the first redressing in such patients only a partial "take" of the grafts is found. Afterwards, in cases of success of the general therapy the remaining viable portions of the grafts begin to proliferate rapidly along the periphery, in parallel with a definite epithelializ tion of the edges of the defect. These regenerative processes progress against the background of the improving general condition of the patient. However, it also happens that the skin grafts which "take" at first, at least partially, decrease in size from dressing to dressing, waste away, so to speak, and the small girdle of young epidermis surrounding the burn wound also undergoes lysis. From time to time, the process of epithelialization is also disturbed in the donor areas in such patients. Despite the intact germinal layer of epidermis left here, the regeneration of the skin stops, and pathological granulations with a sparse purulent exudate appear at the site from which the split-thickness graft was taken. Such a deterioration of the regeneration process is one of the signs of increasing septicemia with a considerable decrease in the content of protein in the blood and anemia. The patients can be brought out of this serious condition only by the vigorous use of comprehensive therapy (regular transfusions of freshly citrated blood, plasma, protein substitutes, vitaminization, proper use of antibiotics, nutrition, good care). As soon as the signs of septicemia abate, the negligible residues of previo sly transplanted skin, which have almost disappeared on the background of a fibrinous-purulent covering, begin to proliferate vigorously, and marginal epithelialization of the wound is again found. The donor areas are also epithelialized.

In the various clinical types of outcomes of skin grafting described the general rules and regulations of the interrelations and interrelatedness of the local and the general, particularly in burn sickness, are manifested. The outcome of the skin transplantation influences (in combination with other measures) the course of burn septicemia; the degree of septicemia influences the outcome of the transplantations. In order to achieve success it is essential to combine skin transplantation with vigorous comprehensive therapy of the burn patients in the pre- and post-operative periods.

## Change in the Microflora of Burned Surfaces

N. I. Lavrent'yev, Lieutenant Colonel of the Medical Service

At the present time, the view is generally accepted that any burned surface should be regarded as a fresh infected wound and that the severity of the phenomena which develop after the shock is over depends on the infection. However, despite this, the study of the bacterial flora of burn wounds has been given undeservedly little attention.

We set before ourselves the problem of studying the species composition of the microflora encountered on burned surfaces at the time of admission of patients to the hospital and at stages of treatment by various methods and measures in their qualitative and quantitative aspects. With the aim of detecting possible sources of infection of the burned surfaces we made a study of the microflora of the healthy areas of the skin in the immediate vicinity of the burned areas and at some distance from them, the microflora of the skin of the hands and pharyns of patients among the service personnel, as well as the microflora of the air in the bandaging room and wards.

Taking into consideration the defects of existing methods of determining the number of microorganisms on various surfaces, we suggested a modified method of agar impressions for this purpose.

It consists of the following: a gauze circle with a stem at its margin was put into a Petri dish of five to six centimeters in diameter so that the stem projected beyond the edge of the dish, and then it was covered with the Petri dish cover (Fig. 1). The Petri dishes prepared in this way are sterilized, and then agar is poured into them; after the agar cools the agar plate is extracted by the gauze stalk and is applied to the surface being examined for the purpose of taking an impression. The agar impression is again put into the dish, which is then placed in a thermostat. After a day, in the majority of cases, it is readily possible to count the number of colonies which grow out, and then also to determine the number of various species of microbes.

We tried out this method on hard surfaces (table, board) which had been artificially contaminated with the Bacillus prodigiosus, as well as on the skin of a healthy person, after which we began to test the method on the burn areas of the patients; the testing showed that the method was quite reliable.

We collected material from 129 patients with burns.

The burned surfaces of the patients which were of various degrees were subjected to bacteriological examination. The microflora of the burned areas was studied dynamically, beginning with the time of admission of the patients to the hospital and ending with the time of discharge from the hospital.

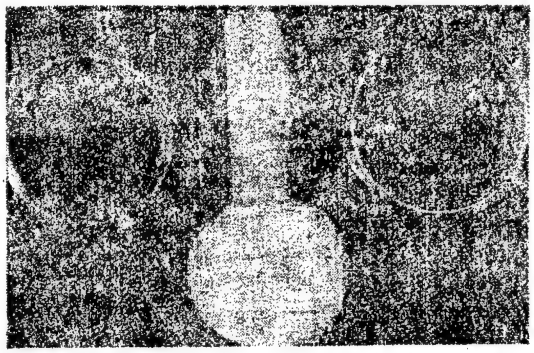


Fig. 1

In all, 452 examinations were performed. Certain patients were examined once, because after the débridement they were discharged for outpatient treatment; the majority were investigated up to 15 times. Among those examined there was one patient with a first-degree burn; second-degree, 44; third-degree, 82; fourth-degree, two patients. The localization of the burn injuries was different, chiefly on the lower and upper extremities. The causes of the burns were also various: burns from boiling water, from hot food, etc. -- 86 cases; with a flame, 39; with electricity, three; with acid, one.

The species composition of the microbes isolated was studied and determined by means of examining the morphological, biochemical and pathogenic properties. The pathogenicity of staphylococci was determined by the Gross method. The data concerning the frequency of microbial species encountered on the burned surfaces are presented in the Table.

As is seen from the Table, at the time of admission of the patients to the hospital the microflora of the burned areas was no different in species composition from the microflora which is found in the same areas during the process of treatment. In both cases it is represented chiefly by the coccal group of bacteria which account for the majority of findings with respect to the frequency and concentration of bacteria in the burn wounds. However, from the same Table it is seen that the quantitative relationships between the microflora of the burned surfaces at the time of admission of patients to the hospital and during the course of

treatment differ considerably with respect to the frequency with which they are found and their concentration in the burn wound. The frequency of finding the majority of microbial species in the burned areas drops considerably during the course of treatment, but the concentration of these microbes increases markedly in half of the cases. This applies particularly to the Bacillus pyocyaneus, the Staphylococcus aureus and Staphylococcus hemolyticus.

| Species of microbes | Microflora of burned areas | |
|---|---|---|
| | At the time of admission of patients to the hospital | During the course of treatment |
| | Frequency of occurrence in % | |
| Staphylococcus albus..... | 82.9 | 43.0 |
| Staphylococcus aureus and cream-colored staphylococcus..... | 40.3 | 35.4 |
| Staphylococcus citreus..... | 17.0 | 4.4 |
| Sarcinae..... | 64.3 | 7.8 |
| Micrococci..... | 41.1 | 17.4 |
| Streptococcus hemolyticus..... | 15.6 | 5.7 |
| Streptococcus nonhemolyticus... | 5.4 | 4.3 |
| Streptococcus viridans..... | 5.4 | 1.0 |
| Anaerobic streptococcus..... | 0.8 | - |
| Diphtheroids..... | 30.2 | 16.5 |
| Bacillus pyocyaneus..... | 3.2 | 31.7 |
| Bacillus coli..... | 3.2 | 0.2 |
| Morgan's bacillus..... | - | 0.2 |
| Friedlander's bacillus..... | 0.8 | 0.4 |
| Bacillus sporogenes..... | 58.9 | 13.7 |
| Bacillus hemophilus [influenzae] | 1.5 | 0.2 |
| Bacillus alkaligenes..... | 0.8 | 0.4 |
| Proteus..... | 0.8 | 5.9 |
| Fungi..... | 9.3 | 5.7 |
| Yeasts..... | 8.5 | 9.9 |
| Enterococcus..... | 0.8 | 0.4 |
| Perfringens..... | 3.2 | 0.8 |
| Putrificus..... | 0.8 | - |
| Sporogenes..... | - | 0.4 |

We are inclined to explain the smaller numbers of the majority of microbial species by the effect of antibiotics on them, which, as a rule, were used for the treatment of patients with burns. The increase in the concentration in

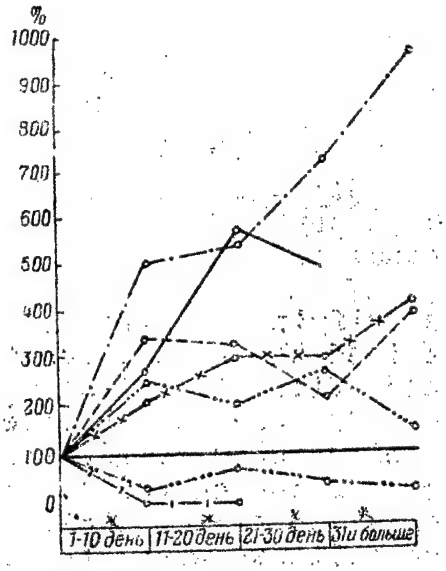
the burned surfaces of the Staphylocci aureus and albus as well as of the hemolytic staphylococcus, we believe, should be related to the occurrence of forms resistant to antibiotics.

With the aim of clarifying the effect of débridement on the microflora we examined the burned surfaces before the surgical treatment and after it. In all, 258 examinations were made; of these 129 were made before, and 129, after the débridement. Before débridement microorganisms were found in 99.3 percent of the cultures. After débridement the growth of microbes was found in 84.5 percent of the cultures; the rest of the cultures were sterile. Before débridement the total number of colonies which grew out in the cultures was 18,680; after débridement, 9,300. Therefore, the concentration of bacteria in the burned surfaces was cut in half. It should be noted that the number of microbial species found after débridement also decreased, on the average, by 35.7 percent.

Study of the effect of various therapeutic agents on the microflora of the burned surfaces was begun with an analysis of the change in species composition of the microbes according to the days of the disease. It was established that after the use of 10 percent synthomycin [chloramphenicol] ointment (22 persons) from the second through the 26th day the patients were in the hospital the burned surfaces were sterile 21 times. In the group of patients (18 persons) in whom the antibiotic was not used there were no sterile burned surfaces encountered. The effect of various therapeutic agents on the microflora was even more notable. In Fig. 2 the concentration of bacteria in the burn wounds is shown at the time of admission of the patients to the hospital and during the course of treatment. These data indicate quite convincingly that the local application of ten or five percent synthomycin ointment to the burned surfaces is much more effective than the other measures of treatment used according to the bacteriologic indices.

Five hundred and seventy-five cultures of isolated staphylococci were examined for pathogenicity. Thereby, among the Staphylococci albi unconditionally pathogenic representatives were isolated only in six percent of the cases, whereas in the Staphylococcus aureus they were found in 79 percent, and in the case of the cream-colored staphylococcus, in 30 percent.

Study of the possible sources of contamination showed that in the healthy areas of skin in the immediate vicinity of the burned area and at some distance from them and in the mucus of the patients' pharynges the same species of microbes are often encountered which are found on the burned surfaces.




* days

—·—·— 10% Synthomycin ointment
— ı — ı — 5% Synthomycin ointment
—x—x— 1% Synthomycin ointment
——·—·—— Penicillin ointment
— — — — — Treatment without antibiotics
——·——·—— Aseptic dressing without débridement
———————— Penicillin ointment without débridement
▬▬▬▬▬▬▬▬ At the time of admission of the patient

g. 2. The Dynamics of the Microbial Seeding of Burned Surfaces Depending on the Use of Various Therapeutic Measures

Examinations of the air were made chiefly in the essing room of patients with burns, where at various mes the burned surfaces were exposed and where, therefore, e presence of various microorganisms in the air and infecon of the burned surfaces of the patients was possible. was established that staphylococci (albus, citreus and reus), micrococci, sarcinae, sporogenous bacilli and phtheroids, fungi and yeasts, Proteus vulgaris and, much ss often, hemolytic and nonhemolytic staphylococci as ll as the Bacillus pyocyaneus, were found most often in e air of the rooms examined.

Therefore, the air in the dressing room contains iefly the same microorganisms which are constantly found the burned surfaces of the patient.

## Conclusions

1. The microflora of burn wounds is represented by more than 24 species. Among them the coccal group occupies the leading place, among which the majority of representatives is pathogenic.

2. In the microflora of the burn wounds the same species of microbes are encountered as on the healthy areas of skin, in the patients' pharynges, and in the air of the dressing room.

3. Under the influence of débridement of burn wounds the concentration of microbes is cut in half. In 15.5 percent of cases the burns surfaces are sterile.

4. Local application of ten and five percent synthomycin ointment according to the bacteriological indices is most effective when compared with other treatment measures.

# The Absorptive Power of a Burn Wound

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In the pathogenesis of thermal burns an important part is played by the absorptive power of the burn; nevertheless, this problem has been extremely inadequately studied. The importance of this problem is determined by the fact that in tissues affected by the burn toxic products of protein autolysis accumulate. It is customarily considered that these toxins are absorbed under certain conditions and are carried by the blood and lymph throughout the entire body (I. N. Ishchenko and M. P. Lebedeva, P. A. Nalivkin, N. A. Fedorov, S. V. Skurkovich). A clear-cut concept of the dynamics of absorption of products of autolysis is of primary significance for understanding the pathogenesis of burns and, therefore, also for the treatment of this disease (Yu. Yu. Dzhanelidze).

A study of the absorption from the burned surface is of interest also in the evaluation of various methods of topical treatment of the burn wound with antiseptics, tanning agents, and other preparations. Not uncommonly, cases are described in the literature of an excessive absorption of the compounds mentioned, which in itself can exert a toxic effect on the body (B. N. Postnikov, Hooker and Lamb, and others).

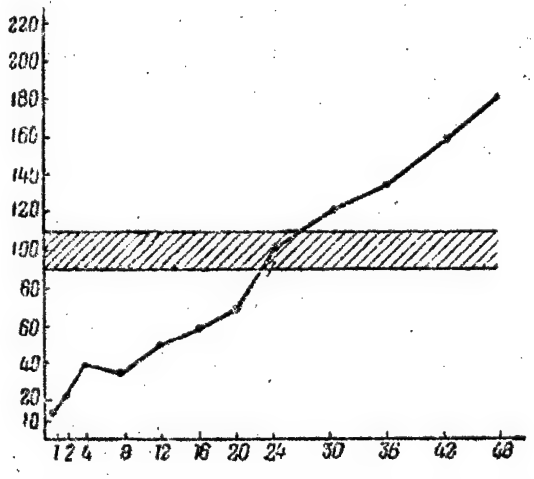
The investigation of the absorption of various substances from the burn surface has been made by a number of authors; however, the data obtained have been very contradictory. Thus, one group of research workers (V. I. Baydak, L. I. Dorofeyeva, Mason and others) believes that after a burn of the skin and deeper layers the rate of absorption from the focus is increased. Other authors adhere to the opposite point of view and assert that as a result of the influence of high temperature the absorption power, particularly during the first three days after the burn, is decreased to a considerable degree (I. R. Petrov, Ye. A. Pchelina and others).

We set before ourselves the problem of investigating the absorptive power of the burned surface experimentally after the infliction of a third-degree burn. The experiments were performed on 180 white rats weighing 100-150 grams. Study of the absorption was carried out by means of radioactive methionine, which is α-amino-γ-methyl-thiobutyric acid which contains tagged sulfur, $S^{35}$. The burn was inflicted on the anterior abdominal wall of the animals over

an area of 15-18 square centimeters. The solution of radioactive methionine was injected under the necrotic eschar immediately after the burn was inflicted in a quantity of 30,000 impulses per gram of weight of the animal in 0.5 cubic centimeter of physiologic solution.

The degree of absorption was determined by the radioactivity of blood taken from the rats after decapitation 45-50 minutes after beginning the experiment. The radioactivity of the blood was established by means of an end-type MST-20 counter with the aid of a type "B" apparatus in the samples of 0.05 cubic centimeters of blood. The time at which the blood was to be taken was determined experimentally. It corresponded to the period of maximum concentration of the methionine in the blood of control rats after the subcutaneous injection of a standard dose. In these control experiments the blood was taken from the animals by means of periodic cardiac punctures.

The absorptive power of the burned surfaces was studied dynamically one, two, four, eight, 12, 16, 20, 24, 30, 36, 42, and 48 hours after beginning the experiment. A group of rats consisting of ten animals (in five of them the burn had been inflicted with boiling water; in five, through contact with an incandescent metal plate) was examined at each of these times. The data obtained (see Figure) were expressed in percentages of the activity of the blood of three to five control rats which had been additionally examined in parallel with each series of experiments. The absorption from the burns, which had been produced by boiling water and incandescent metal, proved to be the same fundamentally.




Graph of Changes in the Degree of Absorption of Radioactive Methionine from the Burned Surface of Rats (Average Data)

The following data were obtained as a result of the experiments. The absorptive power of the burn wound initially after the trauma was found to be depressed. Thus, it was found through investigations carried out two, four, and eight hours after the burn that at these times no more than 30-40 percent of the methionine is absorbed from the burn surface compared with that absorbed in the control animals. The absorptive function is particularly markedly reduced one hour after the burn, at which time an average of 18 percent of the methionine is found in the blood of the rats compared with the control level. Gradually, the absorptive power of the burn wound is increased, and 12-16 hours after the trauma an average of 50-60 percent of the methionine is absorbed compared with the control figures; after 20 hours, up to 70 percent. However, only at the end of the first and beginning of the second day after the beginning of the experiment did the degree of methionine absorption from the burned surface come up to the level characteristic of control animals.

Investigations of the absorptive power throughout the second day after the burn showed a discontinuous increase in it. Thirty-six hours after the trauma, the absorption from the burned tissues exceeded the normal degree of absorption by an average of 35 percent. The absorptive power was increased even more at the end of the second day after the burn, at which time the methionine absorption from the wound exceeded the control figures by almost twice. Individual experiments which we performed at later periods after the experiment was begun (four to seven days) show that even at this time the absorption power of the burned surfaces continues to be above that characteristic of control animals.

Our data concerning the decrease in the absorption from the wound during the first day are in agreement with the investigations of A. A. Vishnevskiy, G. D. Vilyavin and I. R. Petrov concerning the neurogenic nature of primary burn shock, since the established reduction in absorption initially after the burn apparently contradicts the ideas of the toxic origin of burn shock. Our everyday, very conclusive clinical observations of pathogenetic therapy of nerve-reflex disturbances in burn shock attest to this. Afterwards, however, the increase in the absorptive power of the burn wound leads to an active penetration of toxic products into the body. According to the data of V. P. Gorbatov, Wilson and other authors, these toxins are found in the burn wound as early as five to six hours after the trauma.

The fact which we have established of the progressively

increasing intensity of absorption from the burn surface, it must be supposed, can serve as a theoretical basis for the phase of toxemia which regularly occurs in burn patients, usually beginning with the second day after the trauma.

Patient Z., was admitted to the Institute of Surgery imeni A. V. Vishnevskiy for third-degree flame burns of 85 percent of the body surface. At the time of admission, the patient was in a serious condition: consciousness was clouded; the skin was cyanotic; the body temperature was 35.7°, blood pressure -- 90/60, and a thready pulse.

After a bilateral lumbar block according to the A. V. Vishnevskiy method, the injection of morphine, heating, transfusion of preserved blood and polyglucin, the patient's condition improved notably. A day after the trauma the patient answered questions; the body temperature rose to 36.8°; the blood pressure reached 130/70; the pulse became of good quality and of good tension and was 100 beats a minute. The patient was in this condition for another 36 hours. Then, the patient's condition deteriorated; she fell into an unconscious state and, despite all the measures taken, she died. On anatomic examination of the body a toxic dystrophy of the parenchymatous organs was found.

Two periods can be distinguished in the course of the patient's disease. The first period was a state of decompensated burn shock from which the patient was brought out successfully by pathogenetic treatment; and a second period, acute intoxication, which developed in the second day after the trauma and which caused the patient's death despite all therapeutic measures.

The mechanism of the changes in the absorptive power of the burn wound described is complex. However, current data permit us to believe that the considerable nerve-reflex changes which occur in burns underlie these phenomena (A. A. Vishnevskiy) leading to disturbances in the tissue circulation and alterations of the capillary permeability (I. R. Petrov, K. F. Dogayeva, S. I. Itkin, O. V. Shumova, and others).

Study of the mechanisms of the possible persistent reduction in the perifocal absorptive power of the tissues as well as a search for the most effective but protective methods of treating the burn surface in the early periods after the burn can, we believe, definitely contribute to controlling the serious symptoms of toxemia in burn sickness.

## Post-Burn Hypochromic Anemia

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Extensive burns, by producing definite disturbances in all the organs and systems, are reflected on the blood system also.

After a brief (up to three or four days) peripheral hemoconcentration, at which time the erythrocyte count increases to 5,000,000 to 6,000,000 per cubic millimeter of blood and the concentration of hemoglobin increases to 90-140 percent, a persistent decrease in the hemoglobin concentration to 20-40 percent and a reduction in the red blood count to 2,000,000 to 3,000,000 per cubic millimeter of blood may be observed from the end of the second to the beginning of the third week in part of the patients, that is, a true post-burn anemia develops. It is distinguished from the brief and insignificant reduction in hemoglobin concentration and of the red blood count (from the third through the seventh day) by its duration and resistance to therapeutic measures.

Contradictory views exist as to the origin of post-burn anemia.

A number of authors (A. A. Zhuravlev, Yu. Yu. Dzhanelidze, Moore, and others) ascribe great importance to primary hemolysis of the red blood cells. A destruction of the red blood cells in the blood stream after the effect of a thermal agent was shown by the investigations of Wertheim (1868), V. N. Avdakov (1876) and A. P. Ostapenko (1882). The following are expressions of intravascular hemolysis: pink staining of the plasma, increased concentration of blood bilirubin, urobilinuria, hemoglobinuria, increase in the number of erythrophages and increased hemosiderosis of the liver and spleen.

The authors of the past century considered the destruction of erythrocytes to be the direct cause of death from burns. A. Troyanov, and later Shen and Fleming showed that hemolysis in burns is maintained briefly (no more than 72 hours) and does not lead to such a marked reduction in hemoglobin and in the red blood count as to cause death. According to the observations of Yu. Yu. Dzhanelidze (1939) and Harkins (1945) reverse hydremia plays a definite part in the development of anemia, that is, the absorption into the blood stream of excessive exudate beginning with three to five days after the burn. Some authors consider hemorrhage from the granulations to be the cause of the secondary hypochromic anemia in burns; others, a depression of erythropoieses. James and Abbot have shown that in large burns the

synthesis of hemoglobin lags considerably behind its destruction.

The occurrence of such a prolonged reduction in hemoglobin and in the red blood count in burns can hardly be explained by hydremia and primary hemolysis. The duration of hydremia and of primary hemolysis does not exceed several days, whereas anemia in burns is maintained up to a month or more (B. N. Postnikov, Brown). The insignificant hemorrhages which are observed from the granulations should exert a stimulating effect on erythropoiesis (Ya. G. Ushanskiy).

Examination of the bone marrow can give the correct answer to the origin of anemia in burns. However, the few works which have been devoted to the intravital study of bone marrow in burns chiefly concern only the first stages of the burns (shock, toxemia). Later bone marrow changes, when the development of anemia is observed, have practically not been studied. The present work is also devoted to this problem.

There were patients with burns of different degrees of severity under our observation who were treated in the clinic of hospital surgery. In all, 71 persons were examined; of these there were 29 men and 42 women. In 32 patients the burns had been sustained during work; in 39, under domestic conditions. Thirteen of the patients examined were from 17 to 20 years of age; 15, from 21 to 30 years of age; 12, from 31 to 40 years of age; 19, from 41 to 50 years of age; 12, over 51 years of age.

There were 13 patients with burns of less than five percent of the body surface; 16, of six to 10 percent; 20, of 11-20 percent; 11, 21-30 percent; 11 persons, over 31 percent.

In 55 patients the burns were of third- to fourth-degree severity; in the others, up to second-degree. In 20 cases the burns were complicated by shock; in 12, they terminated fatally at different intervals after the trauma. In all the patients the peripheral blood was examined during the first four days every day; subsequently, at four-five day intervals. Bone-marrow puncture was performed according to the generally accepted method of M. I. Arinkin at the time of admission, at the height of the toxemia, with the appearance of secondary suppurative complications, and during the period of recovery.

In patients of the first group (burns of less than five percent of the body surface) no notable changes in the red blood count or the percentage of hemaglobin could be noted. Only in eight out of 13 persons examined was a brief (48-72 hours) neutrophilic leukocytosis (up to 9100-12,650 per cubic millimeter of blood) noted with a shift to the

left.

In the second group (burns of six to 10 percent of the body surface) an increase in the hemoglobin content (to 75-95 percent) was shown in four patients and of the red blood count (to 4,500,000-5,700,000 per cubic millimeter of blood) for two to four days. Beginning with the third through the seventh day a decrease in the red blood count was noted in nine out of 16 persons examined by 300,000-700,000 and in the percentage of hemaglobin by six to 10 percent. This reduction was of a temporary nature; by the fourteenth-nineteenth day after the burn the percentage of hemoglobin and red blood count increased considerably. In 14 patients of this group an early leukocytosis of the peripheral blood (up to 9350-20,000 per cubic millimeter of blood) was noted, which in third-degree burns was maintained up to 11-14 days; there was a shift to the left in the leukocyte formula. No development of any persistent anemia was noted in the patients of either the first or the second group.

In the group of those examined (20) with burns of from 11 to 20 percent of the body surface signs attesting to the development of hemoconcentration were found most often (in 13) (hemoglobin in various patients increased to 95 percent; the red blood count increased to 6,200,000 per cubic millimeter of blood). The duration of the hemoconcentration period did not exceed three to six days. The most pronounced hemoconcentration occurred 36-48 hours after the burn.

In contrast to the preceding groups, in seven of the persons examined who had burns of 11 to 20 percent of the body surface a chronic hypochromic anemia developed (hemoglobin concentration decreased to 40-52 percent; red blood count decreased to 2,160,000-3,190,000 per cubic millimeter). In five patients the anemia appeared beginning with the end of the second-beginning of the third week; in two, from the third to the fourth day after the burn. Anemia in patients of this group lasted from 20 to 168 days, 114 days on the average. In 18 patients a neutrophilic leukocytosis was noted which in third-fourth-degree burns persisted up to 28-35 days. A pronounced neutrophilia with a shift in the formula down to the myelocyte level was found.

In burns of from 21 to 30 percent of the body surface signs of concentration of the peripheral blood were found in all patients (11) during the first three to six days after the trauma with an increase in the hemoglobin concentration of 110-112 percent; in the red blood count to 5,500,000-6,500,000 per cubic millimeter of blood. In more than half (in seven) a chronic hypochromic anemia developed (red blood

count decreased to 2,380,000-3,760,000 per cubic millimeter of blood; the percentage of hemoglobin dropped to 50-58). In six patients the anemia developed beginning with the ninth to fourteenth day; in one, beginning with the sixth day after the burn. Anemia continued depending on the severity of the burn from 26 to 90 days. In all the patients of this group a pronounced neutrophilic leukocytosis with a shift of the leukocytic formula down to the promyelocyte level was found. Leukocytosis of the peripheral blood in second-degree burns persisted for three to five days; in third-degree burns; 12-39 days. In patients with extensive burns (more than 41 percent of the body surface) an increase in the red blood count was found (in certain patients up to 6,220,000 per cubic millimeter of blood) and in the hemoglobin concentration (to 112-116 percent), which constituted evidence of the development of hemoconcentration. The period of hemoconcentration in the patients of this group was equal to three to four days. In five patients whom we managed to observe for a longer time (the others died during the first few days after the burn), a chronic hypochromic anemia developed beginning with the fifteenth-sixteenth day of the disease. The hemoglobin dropped to 29-45 percent; the red blood count, to 2,440,000-3,080,000 per cubic millimeter of blood. In two patients anemia was temporary, despite the duration of the course (about 40 days). At the time of recovery the red blood count and the percentage of hemoglobin had returned to normal. In three patients recovery of these indices was not observed. Two patients died in the late periods after the burn (on the 78th and 169th day) with the presence of a pronounced exhaustion, bed-sores and a persistent hypoproteinemia. One patient was discharged to outpatient treatment with signs of hypochromic anemia (hemoglobin 46 percent, red blood count 2,660,000 per cubic millimeter of blood) on the 138th day after the burn.

The use of Vitamin $B_{12}$, iron, ascorbic acid and gastric juice for persistent anemia proved to be ineffective in the majority of patients; blood transfusion in combination with these measures produced an insignificant increase in the percentage of hemoglobin and in the red blood count in certain cases. Neutrophilic leukocytosis was noted in all patients, and lasted up to 49-76 or more days.

It was established through investigations of the bone marrow that the increase in the number of leukocytes in burns was of an absolute nature. In the bone marrow smears a distinct increase was observed in the young forms of the neutrophilic series; here, a definite relationship was observed between the severity of the burn and the bone marrow changes. Thus, while in burns of less than 10 percent of

the body surface an increase in the myelo- and metamyelocytes was observed, in more extensive burns the number of promyelo- and metamyelocytes increased considerably in the bone marrow smears, and a disassociation was observed in the maturation of the nucleus of the myelocytes and promyelocytes (mature nucleus, purple cytoplasm). The strain on neutrophilic myelopoiesis was observed quite early (one to three hours after the burn).

The increase in the proliferation of the promyelo- and metamyelocytes progressed in the stage of toxemia and of secondary suppurative complications, which always coincided with the more pronounced leukocytosis of the peripheral blood. During the recovery period a tendency was observed toward normalization of the composition of the bone marrow smears, a reduction in the white blood count in the peripheral blood and a normalization of the differential white count.

In the examination of the bone marrow smears no data attesting to a stimulation of erythropoieses were noted in a single patient. It is possible that this is associated with the comparatively late examination of the bone marrow. Without denying the existence of stimulation of erythropoieses during the first few minutes after the burn we could not connect the polyglobulia in the burns with the increase in erythropoiesis on the basis of the data obtained, because when the peripheral blood was taken quite early no increase was observed in the reticulocyte count. It should be supposed that the main cause of hemoconcentration was a loss of plasma and a redistribution of the blood.

A characteristic feature of the bone marrow smears was the depression of erythropoiesis which was expressed in a reduction of the total erythroblast count, delay in maturation of the acidophilic forms of erythroblasts, a reduction in the number of mitotic figures of cells of the erythroid series, reduction in the content of reticulocytes in the peripheral blood and bone marrow. A definite relationship was observed between the severity of the burn and the nature of erythropoiesis in the change in the hemoglobin concentration and in the red blood count and also in the degree of depression of erythropoiesis. Thus, for example, in burns of less than five percent of the body surface the reduction in the total erythroblast count (to 10.2-10.4 percent) was found in two out of 13 persons examined. In burns of from six to 10 percent of the body surface the reduction in the erythroblast content (to 5.5-7.5 percent) was noted in seven out of 16 persons examined at the time of admission and, during the period of toxemia, in all the persons examined (to 7.8-12.2 percent).

During the first few hours after the burn with injury to 11 to 20 percent of the body surface the erythroblast count was reduced (to 7.8-12.2 percent) in more than half of those examined, while in the stage of toxemia and septicemia it was reduced in all (to 2.4-14.2 percent). More extensive burns were accompanied by an even more marked reduction in the number of erythroblasts in the bone marrow smears; frequently the number of them did not exceed two to 2.2 percent.

In partial erythrograms of all the subjects the polychromatophilic forms of erythroblasts were markedly predominant (54.5-62 percent) over the acidophilic forms. The content of peripheral blood reticulocytes did not exceed 0.1-0.2 percent; only with a tendency toward recovery of the normal hemoglobin level and normal red blood count did their index increase to 0.5-1.0 percent. The erythroblastic index of the bone marrow in patients with extensive burns in cases of hypochromic anemia increased to 20.0-90.0.

Therefore, it may be noted that a depression of erytrhopoiesis is predominant in burns, the degree of expression of which is in relation to the severity of the burn. It should be supposed that the depression of erythropoiesis during the first few hours and days after the burn is associated with a marked pain-nerve trauma; subsequently, with toxic septic influences from the burn wound. Confirmation of the nerve-reflex (pain) influences on hematopoiesis in burns was the fact that the depression of erythropoiesis (reduction in the erythroblast count, delay in maturation of the acidophilic erythroblasts, increase in the erythroblast index) was observed early, even before the development of shock, prior to the occurrence of hemoconcentration and suppuration in the wound. During the period of toxemia and the development of suppuration in the wound erythropoiesis was depressed even further. Proof of the toxic-septic influences on the hematopoiesis is constituted by observations on the change in the peripheral blood during operative procedures (necrectomy and grafting) in the burn patients.

In all, 46 operations were performed in the patients whom we examined: 15 out of 25 patients were operated twice or more. The operative procedures were distributed in the following fashion: early grafting of the wounds formed after the excision of tissues in the area of third-degree burns before the appearance of granulation tissue and before the onset of separation of the eschar (during the period from two days to 13-15 days after the burn)--21; grafting of granulating wounds with the excision of necrotic tissues (beginning with the third week after the burn)--12; grafting of clean granulating wounds before the appearance of clinical

signs of contraction of the wound. During the period of the third to sixth week after the burn)--13. The greatest number of operative procedures was performed in patients with extensive burns (19--in patients with burns from 11 to 20 percent of the body surface; 13--in patients with burns of more than 31 percent of the body surface; 11, in patients with burns of from 21 to 30 percent of the body surface). Because of this frequently a complete excision of areas of the third-degree burn or of necroses was accomplished only in part of the operation (20); in the other cases, the necrotic tissues were excised partially (15-20 percent). In 36 cases the operations were performed under ether-oxygen anesthesis; in 10 of them, with the use of hypothermia; 10 operations were performed under local anesthesia.

The conditions of the patients before operation were different depending on the time of the operative procedure and the severity of the burn. Before the operation of early wound grafting a fever was observed in all the patients with rises of temperature to 38-39°; chills, marked reduction in appetite, and accelerated sedimentation rate (up to 40-75 millimeters in an hour). In 15 persons operated the hemoglobin concentration was equal to 60-65 percent; in three, 65-75 percent; and in three, 51-55 percent. The red blood count in 14 of the burned patients was 3,500,000-4,000,000; in two, it was less than 3,500,000; in five, more than 4,000,000 per cubic millimeter of blood. In 12 persons operated a leukocytosis peripheral blood was noticed, in six, a hyperleukocytosis (up tp 26,000 per cubic millimeter of blood).

Before grafting of the granulating wounds the condition of the majority of operated patients remained serious. In half of the persons operated the temperature was at a low-grade fever level; in the others, it reached 38-39°. The sedimentation rate in all persons was accelerated. In four patients the concentration of hemoglobin was equal to 45-55 percent; in the others, 60-75 percent. The red blood count in eight burned patients reached 3,610,000-4,200,000; in the others it was less than 3,000,000 per cubic millimeter of blood. At the time of grafting of the clean granulating wound the conditions of the operated patients were different depending on the nature of the burn.

In extensive burns with the superimposition of secondary complications the condition of the patients continued to deteriorate. Exhaustion, hypochromic anemia, and hypoproteinemia developed. The temperature was at a low-grade fever level, and the neutrophilic leukocytosis persisted. With localized burns the patients' conditions improved. The temperature fell to normal; the peripheral blood leukocytosis

disappeared. In the majority of operated patients, regardless of the nature of the procedure the percentage of hemoglobin and the red blood count dropped on the next day, which was associated with bleeding during necrectomy for excision of granulation tissue as well as with the removal of the skin for grafting; the peripheral blood leukocytosis increased. Only in the operations on patients with localized burns or in the event of use of hypothermia did the white blood count fail to increase the next day after the procedure. In those operated patients in whom complete excision of the necrotic tissues or granulation tissue was performed and in whom secondary suppurative complications were absent the transplanted grafts "took" well. On the seventh to 10th day after the operation the concentration of hemoglobin increased (by 10-20 percent) in them, as did also the red blood count (by 1,000,000-2,000,000 per cubic millimeter of blood); the peripheral blood leukocytosis decreased, and the differential count became normal. This phenomenon was observed in those patients in whom the concentration of hemoglobin had been no higher than 55 percent and the red blood count had been lower than 3,500,000 per cubic millimeter of blood before the operation.

With the occurrence of secondary suppurative complications or partial excision of necroses the composition of the peripheral blood did not become normal by the seventh to 10th day after the operation. In patients with secondary suppurative complications or with partial excision of the necroses, even with a comparatively satisfactory "take" of the transplanted grafts, the anemia progressed, and the peripheral blood leukocytosis remained.

Improvement in the composition of the peripheral blood in the operated patients, in all probability, is associated with the elimination of toxic-septic influences of the purulent-necrotic wound on hematopoiesis.

Therefore, it may be supposed that one of the chief causes of development of anemia in burns is a depression of erythropoiesis and a disturbance in the maturation of the erythroblasts at the stage of the polychromatophilic forms. The degree of intoxication (degree of expression of the toxemia and suppuration in the wound) played the leading part. No development of anemia in patients with second-degree burns or with localized third-degree burns (less than 10 percent of the body surface) could be observed. In burns which were more extensive and deeper anemia was observed almost constantly. In these cases the depression of erythropoiesis was most marked. In accepting the leading role of a disturbance in erythropoieses in the occurrance of chronic post-burn anemia, we are not inclined to deny the

participation of other mechanisms, but they apparently play a secondary role. Thus, in determining the signs of hemolysis in the burned patients a direct parallelism is also observed between the severity of the burn and the degree of expression of the hemolysis.

## Conclusions

1. Development of chronic hypochromic anemia is characteristic only of the deep extensive burns.
2. Depression of erythropoiesis and a disturbance in the maturation of erythroblasts at the stage of the polychromatophilic forms play the leading role in the occurrence of anemia.
3. Operative intervention in burns (necrectomy with grafting) contributes to normalization of the peripheral blood.

## The Nature of Disturbances in the Mechanisms of Gastric Secretion

V. T. Korobitsyn, Lieutenant Colonel of the Medical Service

It is well known that the majority of diseases begins with functional disorders, and only the duration of excessive nature of the stimuli coming from the environment brings the functional disorders to the point of development of morphological changes in the body. Therefore, in order to determine the prognosis correctly and prescribe treatment according to the period of the disease it is important to learn how to determine the initial, relatively latent period of the disease and its subsequent stages. In this connection, the teaching of N. Ye. Vvedenskiy concerning the parabiotic process is of great importance. It has been established through the research of N. Ye. Vvedenskiy that a living system responds with a typical biphasic parabiotic reaction in response to the effect of the most varied stimuli, including also various pharmacologic agents. In the first phase an increase is observed in the lability of the reacting system; in the second, a gradual decrease in it which is characterized by the subsequent appearance of the stage of parabiosis -- transforming, paradoxical and inhibitory.

Basic importance should be ascribed to the paradoxical phase of parabiosis, which is the most striking in its manifestations. During the paradoxical phase the weak and moderate stimuli, and small doses of drugs give a strong reaction, while strong stimuli produce a weak reaction or complete absence of it, that is, an opposite -- paradoxical -- effect is observed.

M. V. Chernorutskiy pointed out that in the initial stage of a disease, during a relatively mild course of it, the processes of excitation predominate over the process of inhibition; in the subsequent intermediate stage of the disease, the growth and distribution of the inhibition process is observed; in the far-advanced stage of the disease, the processes of inhibition with its phasic states predominates markedly over the processes of excitation.

In patients with peptic ulcer a general reduction in the excitability of the cerebral cortex was demonstrated by N. I. Leporskiy during the course of study of the reactivity of the higher nervous centers by the method of optic adequate chronaxie.

It is known that under normal conditions an intense reaction is obtained in a healthy person to stimulation of great strength; a reaction of lesser intensity, to stimulation of lesser strength. Through the works of a number of

authors a different type of reaction of the sick organism has been established at the present time; response reactions to stimuli of different strength are inverted depending on the period or phase of the disease process.

We investigated the gastric contents and were convinced that the inverted response reaction of the neuroglandular apparatus of the stomach in patients with diseases of the stomach is a regular one. At the prsent time, repeated investigations of the gastric contents are being performed in our hospital with the use of test breakfasts with gastric secretion-promoting effects of different strengths in all patients in the internal medical department as a rule. The first examination is only with the use of water as the weakest stimulus. If the response obtained produces a high degree of secretion and high gastric acidity in the contents of the stomach we consider such a reaction, with a certain degree of probability, to be the paradoxical phase of parabiosis. We believe that a simple investigation of the gastric contents performed twice with the use of weak and strong stimuli can indicate the presence of a provisory (equalizing), paradoxical or inhibitory phase of the parabiotic process in the patient.

The sick organism is in a state of development of the pathologic process with certain phases of parabiosis, according to the number of which a certain percentage of cases are also observed with different types of secretion. Thereby, the patients who are in the equalizing phase of parabiosis most often produce the "normal type" of secretion in response to various test breakfasts of different degrees of secretory effect.

As a rule, the early period of the disease produces higher figures of acidity and gastric juice secretion, and only with the intensification of the pathologic process does the acidity of the gastric contents decrease, along with the reduction in the general reactivity of the body, when the processes of inhibition become more distinct as the compensatory protective mechanism.

The figures of the gastric acidity which we obtained in response to stimulation of gastric secretion in a healthy person by such a weak stimulus as water indicate very convincingly the altered reactivity of the patients with gastric disease, chiefly increased activity, which depends, it seems to us, on the short times of having had the disease and on the youth of the patients, at which time the reactivity of the body is greatest. Thus, in 37.5 percent of the patients under our observation a high gastric acidity in response to water was obtained; in 36.5 percent it was normal and only

in 11 percent of the patients did it remain low.

We have noted previously that during the period of recovery the reactivity of the glandular apparatus of the stomach returns to normal, and then water, as a weak stimulus, does not produce the secretory reaction of the stomach ("VMZh" No 12, 1954, page 27). Therefore it should be considered that 11 percent of the patients with a low degree of acidity of the gastric juice in response to water were in a period of recovery, and others, on the other hand, were in a more advanced stage of the disease, at which time the process of inhibition was manifested.

In our hospital about a thousand investigations were performed with the use of water instead of a test breakfast, and the figures presented for the level of gastric acidity indicate the expediency of using such a stimulus, when it is necessary to determine, along with the clinical data, the period or phase of reactivity in the disease process.

In recent years, the investigation of the gastric contents according to the method proposed by K. M. Bykov and I. T. Kurtzin has come to be considered the best ("Terapevticheskiy arkhiv" [Therapeutic Archives], No 1, 1949). In studing the gastric secretion by this method we, naturally, wanted to clarify to what degree the data obtained, which make it possible to establish certain types of gastric secretion, may be regarded from the point of view of the development of the pathologic process. Would not there be different types of gastric secretion as manifestations of the stages of development of the disease, of its different periods, as a reflection of the phasic states of parabiosis?

Our data, obtained through an examination of a large number of patients percentagewise approximate the number of types of secretion in the data of K. M. Bykov and I. T. Kurtsin ("The Cortico-Visceral Theory of the Pathogenesis of Peptic Ulcer," 1952, page 17).

"It seemed to us that while two typical conditions occur in pathology," writes I. T. Kurtsin, "these can be quite easily demonstrated if the neuro-glandular apparatus of the stomach is subjected to prolonged stimulation." (I. T. Kurtsin -- "New Method of Functional Diagnosis of Human Gastric Diseases," 1953, page 132.) Prolonged stimulation of the gastric receptors in certain patients suffering from peptic ulcer produces a secretory reaction which resembles the asthenic reaction, a labile or inert condition of the gland cell; in a number of cases considerably more gastric juice is excreted than by a healthy person in response to the same stimulus. In a pathological condition of the body the "gland cell becomes much more irritable" (I. P. Pavlov) than normally.

From what has been presented it becomes clear that if the author had begun to examine his data from the point of view of the teaching of N. Ye. Vvedenskiy, he would undoubtedly have found in it the expression of various phases of the parabiotic process and various periods in the course of the disease. As a matter of fact, if we examine the characteristics of the types of secretion it may be supposed, and not without reason, that they reflect different periods in the excitation process -- definite phases of parabiosis. The authors of the cortico-visceral theory of peptic ulcer came to this conclusion when they distinctly recorded the level of gastric secretion in dogs during the period of experimental development of gastric neurosis. "It is not hard to see that this reaction of the glands to the effect of stimuli of different strength characterizes a parabiotic state of the neuro-glandular apparatus of the stomach" ("Cortico-Visceral Theory," 1952, page 131).

In our opinion, the excitable and asthenic types can be readily classified as the first phase of development of the pathologic process, and the inert and inhibitory types may be categorized as the second phase of the pathologic process, the phase with the predominance of inhibitory processes. This is why it seems expedient to us to regard the excitable and asthenic types of secretion as the first period in the development of the pathologic process, and the inert and inhibitory types as the second period, which characterizes the definite decrease in the lability of the reacting tissue as the more advanced phase of the disease.

The description of the types of gastric secretion presented below completely justifies this standpoint, it seems to us.

The excitable type is characterized by a markedly increased gastric secretion in the first and second hour of the continuous effect of the stimulus. The quantity of gastric juice in this case is always great -- from 500 to 800 cubic centimeters.

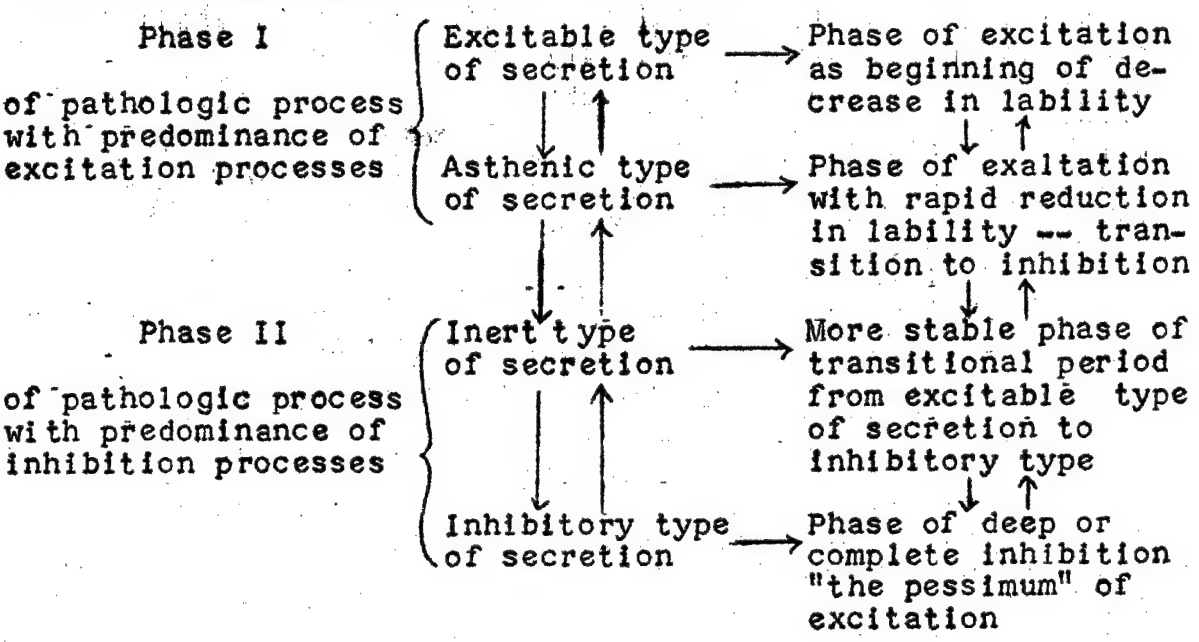
In the asthenic type the volume of gastric secretion in the first hour exceeds this volume in the second hour by four to six times. In patients with the inert type of secretion a sluggish rise in gastric secretion is noted both in the first and second hours of the investigation.

The inhibitory type of gastric secretion is characterized by a markedly increased secretion of gastric juice, despite the prolonged stimulation of the receptor apparatus of the stomach. The hydrochloric acid is markedly reduced or is completely absent.

The clinical picture confirms the fact that the initial

period, as the earliest, is characterized by the predominance of excitation processes, by an increase in secretion; the second, older, far-advanced period is characterized by the predominance of inhibitory processes, by a decrease in secretion to the level of complete achylia. We believe that the development of the process is expediently represented in the form of the following diagram, which intends the introduction of clarity into rather than a simplification of the conception of the process (see diagram).

The Development of the Pathologic Process in Gastric Diseases




Note. We are using physiologic terms here in a clinical sense, and by dividing the course of the pathologic process into two phases we emphasize its duration. The arrows indicate the reversibility of the process.

The facts show that the development of the pathologic process proceeds from the normal type of secretion to the excitable type and through the asthenic and inert types to the inhibitory types, while the recovery of it from the inhibitory type of secretion goes to the excitable and normal types.

Naturally, this diagram, like any other, while it introduces clarity into the concept of the process which occurs can, at the same time, reflect only the key moments in the transitional periods, between which there are a number of variants.

The study of the pathogenesis of peptic ulcer from the standpoint of the development of the pathologic process -- the phase of parabiosis -- can lead to the establishment of specific signs which determine the characteristic features of various stages of the disease. While the data which we have obtained, like the data of other authors, are regular, the study of the pathogenesis of gastric diseases, like the mechanisms of recovery, from the standpoint of the teaching of N. Ye. Vvedenskiy is productive to a considerable degree, and the significance of the elaboration of certain tests indicating the stage nature of the course of the disease is understandable.

The possibility of establishing specific stages in the phase of development of the pathologic process can undoubtedly and should be of considerable benefit to the physician in making a diagnosis and prognosis, in planning the treatment in a better manner, as well as in determining the more specific prophylactic measures.

Therefore, in the course of peptic ulcer, as of any other disease, a periodicity is noted. It is characterized by a predominance of the processes of excitation during the initial period of the disease and a predominance of inhibitory processes during the second, far-advanced period of the disease.

The types of gastric secretion reflect a certain period of development of the pathologic process. The excitable type of gastric secretion indicates the initial period of the disease; the inhibitory type of gastric secretion, a deep-seated, far-advanced period of the disease. The inert and asthenic types of secretion should be regarded as a reflection of the transitional periods of the disease. They may be encountered in the development of the disease and in the recovery period.

The periodic nature of the course is well documented by the appearance and shift of the phases of the parabiotic process as determined by various tests. The phases of the parabiotic process can be used as a criterion of recovery or severity of the disease along with a consideration of the clinical picture of the disease.

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# The Significance of Certain Methods of Investigation in the Diagnosis of Chronic Gastritis

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The problem of chronic gastritis continues to be of current importance both for military medicine and for civilian public health; specifically, problems of diagnosis of this condition need to be worked out.

For the purpose of diagnosis of chronic gastritides various methods have been proposed. However, the great defect of many of them is the fact that they are not checked by such an objective method as gastroscopy.

In the present work we have set before ourselves the aim of clarifying the importance of a number of methods of investigation in the diagnosis of the chronic gastritides, comparing them with the data of gastroscopy. For the purpose of recording the gastroscopic data gastroscopic color photography was performed.

The 430 patients in whom the detailed clinical examination, investigation of the gastric and duodenal contents, roentgenography of the gastrointestinal tract and gastroscopy were performed were in the hospital. In many patients percussion was performed according to the method of Mendel, a determination of the Boas, Openkhovskiy and Herbst points was made, the Zakhar'in-Head areas were investigated, a galvanic test for pain was performed, the types of gastric secretion were studied according to the Bykov-Kurtsin method, chromoscopy of the stomach was done, and an investigation was made of the cellular composition of the gastric contents by various methods. In the majority of patients the investigations were made dynamically. There were 124 patients with chronic gastritides investigated; 6, with acute gastritides; 165, with functional gastric disorders; 126, with peptic ulcers; six, with gastric carcinoma; three, with gastric polyposis.

In the nature of the pains and the localization of them no essential differences were noted between the groups of patients with gastritides and those with functional diseases of the stomach. In the majority of cases the pains were localized in the epigastric region and, less often, in the right subcostal area; they were usually associated with taking food. Sometimes, headaches were observed, but they occurred somewhat more frequently in peptic ulcer. Periodicity and seasonality were most characteristic of patients with peptic ulcer. In all the groups of patients heartburn, belching, nausea, not uncommonly vomiting and a decreased appetite were noted. The duration of the disease was small

(less than one year) in many patients. The majority of persons investigated were young men of sthenic constitution. Persons who showed loss of weight were most often found among the patients with peptic ulcer.

On superficial palpation, tenderness was usually found in the epigastric area in all the patients. The tender points on deep palpation of the abdominal cavity which are considered characteristic of gastric or duodenal ulcer were rarely encountered in the patients with peptic ulcers whom we examined. The same applies to the pain points along the spinal column. Mendel's sign was positive not only in peptic ulcer patients but also in those with gastritides and functional gastric diseases.

An examination of the skin sensitivity was made in 192 persons. In all the diseases the Zakhar'in-Head hyperesthesia and hyperalgesia were not uncommonly found in the area of $D_{VI-XII}$ [error in text here was corrected in next issue of "VMZh"], that is, in the skin segments corresponding to projections of the stomach and intestine. However, nothing characteristic of the individual diseases was established. In many patients, particularly those with functional diseases of the stomach, vegetative disorders were observed (acrocyanosis, hyperhidrosis).

X-ray examination not uncommonly showed a thickening and a smoothing out of the mucosal folds in the functional diseases, that is, where the diagnosis was ruled out by gastroscopy. It must be supposed that the roentgenologically determined change in the outline of the gastric mucosa cannot serve as the grounds for a diagnosis of gastritis.

Gastroscopy and gastrophotography. Numerous authors ascribe importance to gastroscopy in the diagnosis of chronic gastritides (N. S. Smirnov, I. M. Funt, G. A. Smagin and others).

In gastroscopy of patients with functional diseases of the stomach we did not find any pathological changes in a single case. In patients with chronic gastritis the picture of hypertrophic gastritis (granular nodules, unevenness or roughness of the mucosa, segmented nature of the folds) and erosive gastritis was found most often. Less often, a superficial gastritis was encountered (mucosal films, hyperemia), and even less often, atrophic gastritis. The erosions were not found on repeated examinations, because they healed quite rapidly. The picture of superficial gastritis also proved to be inconstant. The changes produced by hypertrophic gastritis did not undergo resolution. In six patients a gastric ulcer was found only by gastroscopy in the presence of negative roentgenologic data. In

three patients a gastric ulcer could not be found by gastroscopy, although the niche was found by X-ray.

We were the first to obtain color films of the gastric mucosa by means of a flexible gastroscope and a photographic attachment.

The gastroscope which we used for this purpose has a bulb with two filaments -- one for ordinary lighting for gastroscopic examination (voltage up to 12 volts); the other, for providing a bright flash of light at the time of taking a picture (voltage -- 180 volts). We used negative color film of average light sensitivity both for artificial light and daylight. In all, 119 color films were made; the quality of them was entirely satisfactory.

Laboratory examination of the gastric contents. In the functional gastric diseases and duodenal ulcer, as a rule, an increased acidity was observed, and in chronic gastritis and gastric ulcer the acidity was normal in the majority of cases. A large quantity of mucus and a large number of white blood cells were found in the gastric juice portion on a fasting stomach in the chronic gastritides and functional diseases. Evidently, the usual examination of the gastric juice taken not only with a large but also with a fine stomach tube (that is, by the fractional method) gives too few data for the diagnosis of gastric diseases. The results obtained do not justify the unpleasant sensations which the patients experience during the passage of the tube and the laborious method of titrating the juice in its many portions.

In connection with this the attempts at investigation of the secretory function of the stomach without the use of a stomach tube deserve attention; although they do not give such precise data as investigation with a stomach tube they eliminate the unpleasant tube-passing procedure. Abroad, the use of the ion-exchange resin, amberlite XE-96 with quinine and azure (the preparations diagnex and diagnex blue) has become widespread for the purpose of establishing the presence of achlorhydria.

Since we did not have the foreign preparations at our disposal, we decided to use one of the Soviet ion-exchange resins. It was established that cationite KB-4 2P resin is completely suitable for this purpose. The investigations showed that one gram of KB-4 2P resin in its hydrogen form is capable of absorbing about 60 milligrams of quinine and 100 milligrams of azure-2, that is, twice as much as the American resin amberlite XE-96.

The toxicity of KB-4 2P was investigated on white mice. The mice were given the resins in doses which exceeded

those needed for the investigation by 40, 60, 90 times. Despite these large doses, the mortality rate of the mice was nil. Afterwards, the resin was checked on people; no side-effects were observed in any case.

The following preparations were prepared for the investigations: KB-4 2P with quinine and KB-4 2P with azure-2. An observation was made of 20 patients in whom the gastric juice was investigated by the fractional method, and then the preparation KB-4 2P was given with quinine, and the quinine content in the urine was determined. The test was based on the fact that the quinine in the preparation is replaced by the hydrogen ions of the hydrochloric acid in the stomach. The liberated quinine is absorbed into the blood and is excreted into the urine. Thereby, the greater the acidity of the gastric juice the more quinine should be excreted in the urine.

The results which we obtained are presented in Table 1.

Table 1

| Concentration of free hydrochloric acid | No of patients | Concentration of quinine in micrograms in two-hour portion of urine | | | | | |
|---|---|---|---|---|---|---|---|
| | | Under 20 | 21-40 | 41-60 | 61-90 | 91-120 | Over 120 |
| 0 | 8 | 7 | 1 | | | | |
| 1-20 | 2 | | 1 | | 1 | | |
| 21-40 | 5 | | | 3 | 2 | | |
| 41-60 | 8 | | | | 6 | 1 | 1 |
| Over 60 | 6 | | | 1 | | 5 | |

As seen from the Table, a correlation is observed basically between the concentration of the free hydrochloric acid in the gastric juice and the quantity of quinine in the portion of urine. This comes out particularly clearly in the presence of achlorhydria, where in almost all cases the content of quinine in the urine does not exceed 20 micrograms, whereas in the presence of free hydrochloric acid in the gastric juice the content quinine in the urine is always more than 20 micrograms.

Determination of the type of gastric secretion according to the Bykov-Kurtsin method. In 99 persons the type of gastric secretion was determined by the Bykov-Kurtsin method. We found the excitable type in a small number of patients with peptic ulcer. It was not uncommonly found in chronic gastritides and even more often in the functional gastric diseases. The inhibitory type of secretion was usually noted

in the functional gastric diseases and peptic ulcer. Therefore, our data do not confirm the conclusion of the authors of the method that the excitable type of secretion is encountered most often in peptic ulcer, while the inhibitory type is found most often in atrophic gastritis.

Chromoscopy of the stomach. This method is based on the property of certain dyes, injected parenterally, of being excreted by the gastric mucosa. Most often, neutral red is used for this purpose. Delayed excretion of the dye is considered a sign of organic diseases of the stomach.

We used the neutral red test in 122 patients. It was shown that in functional gastric diseases the neutral red excretion was normal in only half of the patients; in the rest, the dye was excreted after a delay, and in a number of cases was not excreted at all. In chronic gastritides, the excretion of neutral red was within the proper time in more than half the cases. Therefore, delayed excretion of neutral red is no sign of gastritis.

The galvanic test for pain. The galvanic test for pain was performed in a group of 103 patients; this test was proposed by Albrecht, and by Ye. T. Zal'kindson and D. M. Tsintsadze for diseases of the abdominal organs. In the opinion of these authors, the galvanic test for pain objectivizes the subjective sensation of pain (in a positive test a decreased skin resistance to the current is found).

The test was performed with a galvanization apparatus. The indifferent electrode was placed on the sacrum, and the active one was applied to the anterior abdominal wall. We found this test positive only in a number of cases. Not uncommonly, it was negative despite definite pains in patients with gastric and duodenal ulcers.

Investigation of the cellular composition of the gastric contents. Of the numerous methods which have been proposed for the investigation of the cellular composition of the gastric contents we decided to check the method of determination of emigration of white blood cells from the gastric mucosa by the method of successive irrigations conducted by the M. A. Yasinovskiy method, the method of investigating the cellular composition of the gastric contents in the Westphal-Cukuck manner, and the method of determining gastric leukopedesis suggested by N. I. Leporskiy.

The M. A. Yasinovskiy method was tested on 85 patients. In both chronic gastritides and functional gastric diseases the leucocyte count per cubic millimeter of the irrigation fluid of the stomach was less than 300 in the majority of patients, that is, it did not come up to the figure which, according to the data of the author of the method, is of

diagnostic significance. In the functional gastric diseases and gastritides the relationship of leucocytes to squamous epithelial cells in the irrigation fluid of the stomach was greater than the ratio in irrigation water of the mouth.

The investigation according to the Westphal-Cukuck method was performed in 47 patients. In all the patients, including those with chronic gastritides and gastric ulcer the number of cells in the gastric contents was normal (that is, less than 500 per cubic millimeter). The results of the investigation of the gastric leukopedesis by the N. I. Leporskiy method are presented in Table 2.

Table 2

| Disease of the stomach | No of patients | Number of leucocytes in one cubic millimeter of gastric juice | | |
|---|---|---|---|---|
| | | Less than 600 | 601-1500 | Over 1500 |
| Functional gastric diseases | 61 | 49 | 11 | 1 |
| Gastritides..... | 30 | 2 | 7 | 21 |
| Gastric ulcer..... | 2 | | | 2 |
| Duodenal ulcer..... | 8 | 4 | 2 | 2 |

In this investigation demonstrative data were obtained. While in the functional diseases of the stomach the degree of leukopedesis did not exceed 1500 white blood cells per cubic millimeter of gastric juice (and in the majority not even 600), in the majority of patients with gastritides it was greater than this figure.

## Conclusions

1. Through the comparative evaluation of various methods proposed for the diagnosis of the gastritides, it was shown that the investigation of leukopedesis according to the N. I. Leporskiy method and gastroscopy are of the greatest importance. Other methods are not decisive or substantial.

2. Color gastroscopic photography performed with a specially adapted flexible gastroscope with a photographic attachment gives completely satisfactory color films of the gastric mucosa.

3. For the purpose of establishing the presence of achlorhydria use may be made of a tubeless method using the ion-exchange resin KB-4 2P with quinine or azure-2.

# THE EFFECTIVENESS OF HYGIENIC LAVAGE AS A METHOD OF DISINFECTING THE SKIN SURFACE
[A Translation]

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Moscow, May 1959, pp 73-75

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At the present time, hygienic washing with soap and warm water by people, as a method of disinfection of the body surface, is recommended in full hygienic treatment. However, hygienic lavage does not always produce the expected results. Numerous literature data on the disinfection of the skin integumenta of surgeons' hands testify to the fact that even a prolonged thorough washing of hands with warm water and soap does not ensure asepsis. For this reason, we attempted to determine experimentally the effectiveness of the disinfection of the body surface by means of hygienic lavage.

In the first series of experiments, the dry live vaccine of Brucella abortus bovis (strain 19) was used for infection; the vaccine contained in one gram of dry substance 100 billions of live microorganisms. The skin surface of the subjects was "infected" at the moment of their aerogenic immunization.(1) Immediately following "infection" in several individuals, outwashes were made; these outwashes served as an index of the infection intensity. The outwashes were collected from various skin sectors 10 x 10 cm in area.

The tested individuals washed themselves for 20 minutes with two soapings. A separate shower cabin was assigned to each individual. During the 20-minute period, 47 liters of water at a temperature of 42-43° [C] was discharged from the shower net. After the hygienic lavage, similar outwashings were taken from the same area of the individuals infected during one "infection" scanee. A total of ten persons were tested before lavage, and 21 after lavage.

To collect the outwash material, a sterile napkin meas-

(1) See article of N. I. Aleksandrov and others "Reactogenicity and Effectiveness of Aerogenic Vaccination against Certain Zoonozoa," Voyenno-Medits. Zhurnal, No 12, 1958.

uring 5 x 5 cm in area was moistened slightly in a sterile physiological solution, squeezed out, and then used to wipe off the surface of the skin. The napkin was placed in a jar with 20 mg of a physiological solution and beads, and then was agitated for 4 to 5 minutes. Portions of the physiological solution, 0.2 mg each, were seeded in a cup on agar D. The cup was incubated in a thermostat at a temperature of 37° for 72 hours. All colonies suspected of containing Brucella abortus bovis were subjected to testing, by means of an agglutination reaction with a specific serum.

The results of the experiments for disinfection of the skin via hygienic lavage are shown in Table 1.

Table 1

| Area of "infected" skin | Before washing | | | After washing | | |
|---|---|---|---|---|---|---|
| | out-washes taken | growth observed | No. of colonies | out-washes taken | growth observed | No. of colonies |
| Neck . . . | 3 | 3 | Hundreds | 8 | 7 | 1-9 |
| Hand . . . | 3 | 3 | " | 8 | 7 | 1-13 |
| Foot . . . | 3 | 3 | " | 8 | 7 | 1-10 |
| Shoulder . | 3 | 3 | " | 8 | 8 | 1-20 |
| Chest. . . | 3 | 3 | " | 8 | 2 | 1-2 |
| Back . . . | 3 | 3 | " | 8 | 8 | 1-5 |
| Femur. . . | 3 | 3 | " | 8 | 7 | 1-17 |

As is seen from Table 1, the "infection" of the skin before lavage was very considerable in all places. After lavage a reduction in the number of microorganisms was observed from hundreds to only isolated microbic cells, a fact which bears very important significance for lessening the danger of infection. However, not a single individual showed complete washing off of the microorganisms. Analogous studies were conducted in washing for a period of 15 minutes. The results of the tests proved to be the same.

In the second series of tests, the "infection" was induced by the spores of vaccine strain STI. The method of study remained the same. A part of the wash-off was heated at a temperature of 53-54° for one hour, in order to remove the vegetative microflora taken from the skin. Portions of 0.2 mg of the non-heated outwash were seeded in cups on

meat-pepton agar; and portions of one mg of the heated material--on the meat-pepton bullion. After seven days, inoculations from bullion were made on agar. The suspicious colonies were checked via reaction of thermoprecipitation with a specific serum and through bacterioscopy. The results of the tests with the non-heated part of the outwash material are shown in Table 2.

Table 2

| Area of "infected" skin | Before washing | | | After washing | | |
|---|---|---|---|---|---|---|
| | No. of outwashes taken | growth observed | No. of colonies | No. of outwashes taken | growth observed | No. of colonies |
| Neck . . . | 3 | 3 | Hundreds | 8 | 7 | 1-9 |
| Hand . . . | 3 | 3 | " | 8 | 7 | 1-13 |
| Foot . . . | 3 | 3 | " | 8 | 7 | 1-10 |
| Shoulder . | 3 | 3 | " | 8 | 8 | 1-20 |
| Chest. . . | 3 | 3 | " | 8 | 2 | 1-2 |
| Back . . . | 3 | 3 | " | 8 | 8 | 1-5 |
| Femur. . . | 3 | 3 | " | 8 | 7 | 1-17 |

As is seen from Table 2, in this case, too, an abundant "infection" was observed before washing, while only isolated microorganisms remained after washing. As in the first series of tests, no complete washing off of microbes was achieved in the process of lavage.

Analogous results were obtained upon inoculation with the heated part of the outwash. However, in this case, five times the amount of the physiological solution (one mg) was used for inoculation, and in a series of inoculations, one obtained positive results; however, no growth was observed in the parallel inoculation with the non-heated outwash. Reverse results were occasionally observed; these probably were due to the dying of spores in the process of heating.

In the cited experiments an intensive "infection" of the surface of the unprotected skin was employed. Under natural conditions, within an aerosol medium, clothing apparently protects the skin integumenta. Therefore, we attempted to determine the degree of skin infection, while in an aerosol medium, of people dressed in a gymnastic shirt, trousers, and boots. After having been infected for 15 minutes with a dry culture of the vaccine strain Brucella abortus bovis,

the individuals under observation removed their clothes, and, from various areas of the skin, inoculations with the outwash material were made. The results of the tests testify to the fact that the intensity of infection of the exposed parts of the body (hands) was the same as in previous tests, while the infection in the region of the back and femur was manifested in isolated microorganisms. This "infection" could take place via penetration of the microorganisms through insufficiently close-fitting parts of the clothes, and, upon disrobing, from the secondary aerosols. However, in this case, not the mechanism of "infection" is important, but the mere fact [of infection] which proves the necessity of complete hygienic processing of people who have been exposed to the danger of infection. In order to enhance the effectiveness of disinfection of the skin integumenta during lavage, it is essential to employ, in addition, chemical disinfectant soaps. Probably, the best kinds for this purpose are bactericidal soaps. It is expedient, also, before a hygienic lavage, to rub the entire surface of the skin integumenta with a piece of cloth dipped in a two percent solution of chloramine.

Thus, on the basis of the material presented, one can conclude that, with the aid of a hygienic lavage, there is a considerable reduction in the quantity of vegetative and spore forms of microbes on the skin of individuals exposed to the action of bacterial aerosols. However, no complete disinfection is achieved, and an additional processing of the skin surface with solutions of chemical disinfectants is required.

# AN EXPERIMENTAL STUDY OF THE BACTERIAL CONTAMINATION OF THE AIR IN CLOSED-TYPE LIVING QUARTERS

[A Translation]

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pp 75-77

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During the past decade a large number of investigations was carried out regarding the bacterial contamination and disinfection of the air in closed-type quarters. The increased interest in this subject may be explained by the fact that the extent of bacterial contamination of the air affects the frequency of human morbidity from droplet infections.

It has been demonstrated that a large number of microorganisms, including pathogenic ones, can accumulate in the air of closed-type quarters of surface buildings. In connection with this, the study of microbic infiltration of the air in protective structures assumes important practical and theoretical significance, since no ultra-violet rays of daylight penetrate these structures. The peculiarities of the construction and exploitation of protective structures and shelters may contribute to the accumulation and prolonged circulation of microorganisms in the air.

The bacterial dust in closed-type quarters, in the absence of air circulation, slowly settles on open, mostly horizontal surfaces of objects, the largest amount being concentrated on the floor. This "self-purification" of the air from bacterial dust results in the fact that within 75 minutes the number of microbes is reduced 85-95 percent, as compared to the initial figures (D. I. Kantor, L. I. Mats, R. Williams and others). A slight movement of air again raises bacterial dust. This, precisely, is the reason why investigators found especially large quantities of microbes in the air, when the premises were cleaned in a dry manner.

In the present report are cited the results of the tests on the bacterial contamination of the air, as well as the

basic factors of the formation of bacterial aerosol and of its behavior in the air under various conditions. The work was conducted during various seasons of 1955-1957 in living quarters of a closed type in various climatic zones and under all kinds of ventilation conditions during the presence of people in these quarters.

To take air samples, we used the apparatus of Yu. A. Krotov (model 1955) which was placed at a definite level in the premises, at a height of 1--1.3 meters above the floor; in some cases the samples were taken on two levels--0.3 and 1.3 m above the floor, in order to ascertain the distribution of the microorganisms according to altitude. The apparatus worked under a continuous, highly effective regime and was able to pass 35 liters of air per minute. Inoculation for the general bacterial infiltration was made from 35-70 liters of the passed air on 2-3 percent meat-peptone agar; for the hemolytic microflora--from 250 liters of air on five percent blood agar to which a 1:1,000 aqueous solution of gential-violet was added (0.2 mg of the solution to 100 mg of blood agar).

The count of colonies with the over-all count of the bacterial content in one cubic meter of air was performed after a 24-hour incubation of the seeded cups in a thermostat at 37° [C]. For the purpose of control, a microscopy of smears and their Gram staining were made in certain cases.

The tests demonstrated that bacterial infiltration of the air in living quarters, when people are not present, changes very slightly and constitutes no more than 1,100--1,200 microbes per cubic meter when the hemolytic flora is absent. In living quarters, bacterial contamination increases when the personnel arise or go to sleep, a fact which is, as is known, connected with the disturbance of bed accessories and clothing. No less characteristic is the rapid decrease in bacterial contamination of the air after the people have arisen; 1.5-2 hours, following the riding or preparation for sleep of the personnel, air contamination declines to the initial level. The most probable cause of the rapid decrease of bacterial infiltration in these cases is the settling of the dust phase of the bacterial aerosol, this phase being responsible for the abrupt changes in the extent of bacterial air contamination.

The data on bacterial distribution in the air, according to altitude, also corroborate this statement. During the day, the bacterial infiltration of the air at 0.5 m above

floor-level is 9-13 percent higher, than at the 1.3 m level. In turn, the predominance of the bacterial aerosol dust phase in the air of living quarters depends, as is known, not only on the number of people on the premises, but also on the nature of their work in it, as well as on the sanitary condition of the premises, etc. The bacterial contamination of the air in living quarters usually is much higher than in the administration and service quarters, where the density of the distribution of personnel is lower. When the premises are maintained under improved sanitary conditions, the bacterial air contamination is lower. Seasonal variations of bacterial air contamination are insignificant. For example, in living quarters, during the warm season of the year, the general infiltration constitutes 3,600 microbes in one cubic meter, and during the cold season--about 2,000. By means of inflow-outflow ventilation one can reduce the bacterial air contamination of the premises by 2-3 times. It is characteristic that the variations of microbic infiltration during the functioning of ventilation are less manifested, and the mean figures are considerably lower than after the ventilation of the premises had ceased.

As the bacteriological analysis shows, verious types of cocci, spore bacilli, sarcines, mold fungi, etc. are obtained from the air of the living quarters.

The tests have shown that the character of variations of bacterial infiltration of the air in completely isolated quarters occupied by people does not change; the potential threat of spreading air-droplet infections within the living quarters is thereby enhanced. During three days' tests with complete isolation of the premises, a connection was observed between the length of the test and the increase of microbic infiltration. Thus, if the general infiltration during the first 24 hours constituted 16,100 bacteria per cubic meter, on the third day it increased to 20,700.

The recirculation of the air, with complete isolation, reduces temporarily the bacterial infiltration of the air in living quarters and increases it in the corridors and in quarters not occupied by people.

Tests conducted in closed-type quarters where the ventilating system was equipped with a moist air cooler showed that the processing of the recirculated air in an air cooler leads to a considerable reduction of the bacterial infiltration of the air. Probably, the bacterial dust, due to its hygroscopic properties, is easily removed from the air when

it passes through a screen of water sprays of the air cooler. The variations of microbic infiltration of the air in living quarters of this type of construction are much less pronounced, and the absolute total of bacterial contamination is almost three times lower than in constructions without moist air cooling devices. The microbic infiltration of the recirculating air when it passes through the air coller is approximately 20-30 percent lower.

# The Application of Radioelectronics to Medicine

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Modern medicine would be unthinkable without the application of the most varied technical devices and apparatuses. The incorporation of the technical aspects and physical sciences into clinical practice has become particularly active recently. New technical measures have appeared for objective diagnosis, therapy and prophylaxis of diseases, which sometimes lead to the occurrence not only of various new methods but also new divisions of medical science.

In this progressively expanding quantity of medical technical equipment one of the most important places is rightfully beginning to be taken by radioelectronic devices and apparatuses of different designs and purposes.

As is well known, the electric current in the living body can simultaneously be both the cause and the result of various biological changes. In accordance with this, the use of radioelectronics in medicine is developing along two main routes: first -- experimental and diagnostic study of the action currents of the heart, brain, stomach and other organs of the human body; second -- a therapeutic effect using electric currents of different shapes, duration and amplitude on the living organism and, particularly, on the nervous system.

The application of radioelectronic apparatus to medicine is being expanded every day, embracing almost all the divisions of clinical and experimental medicine. In a single report it does not appear possible to discuss all the problems in the application of radioelectronics to medicine; therefore, we consider it expedient to dwell only on the individual, most important problems of the diagnosis and therapeutic use of it.

Electrical apparatus for functional diagnosis. The activity of various organs of the body as a whole is associated with a number of biophysical indices, the recording and evaluation of which are extremely important and make it possible to judge the existence of normal and pathological states of the body more accurately. Therefore, the investigation of the bioelectrical phenomena in the living body is obtaining a progressively greater range. In addition to the investigation of the action currents of the heart, we are already recording the biological potentials of the brain, stomach, muscles, etc.

Electrocardiographic apparatuses, which at the present time are necessary appurtenances of every medical installation,

have obtained the greatest application for functional diagnosis. Electrocardiography is the recording of electrical impulses which accompany the cardiac activity and was begun 50 years ago; however, the greatest development and advancement of it has occurred after the beginning of use and the distribution of electronic apparatus.

Modern electrocardiographs consist of an input apparatus, amplifier, recording attachment and the supply unit; the latter is accomplished from the alternating current network or from dry-cell batteries. According to the method of recording there are electrocardiographs with photographic recording and those with direct recording (ink-writing or thermal). The simultaneous recording of several leads of an electrocardiogram, the pulse wave, and the blood pressure is of great importance for a more thorough understanding of the activity of the cardiovascular system; therefore, along with single-channel apparatuses for use outside the hospital powerful multichannel apparatuses are now being made.

The new single-channel ELKAR-2 (Fig. 1) electrocardiograph now in production is designed for direct electrocardiographic writing. The portability and light weight of the apparatus make it possible to use it in field medical installations. The power supply of the apparatus comes from an alternating current network with a voltage of 127 or 220 volts; the time of preparing it for recording does not exceed 10 minutes. The record is made by an ink-writing tip on a paper strip which has a one-millimeter grid; the cardiogram obtained is read directly, without any additional processing.

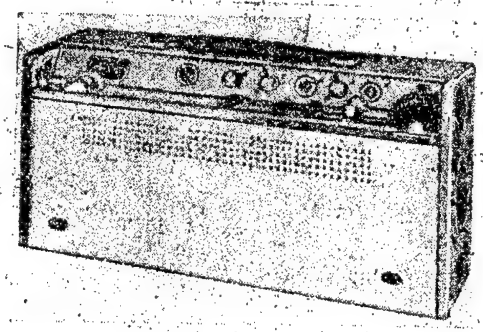


Fig. 1. Portable Electrocardiograph ELKAR-2

The apparatus is simple to use; its weight including the hoses and electrodes is 10 kilograms; its dimensions, 130 x 215 x 395 millimeters.

The appearance of electron-beam tubes has made it possible to create an apparatus which is new in principle --

the vectorelectrocardioscope -- which is designed for the study of the spatial distribution of the action potentials of the heart. The vectorelectrocardioscope (VEKS) provides for the recording and visual observation on an electron-beam tube screen of the vector characteristics of the three-dimensional electric field of the heart in three spatial projections (vectorcardiogram), which makes it possible to obtain reliable data concerning the presence of focal changes in the cardiac muscle. The collapsible photographic chamber of the apparatus provides a documentary record on the film of all the processes observed on the screen of the electron-beam tube. In addition to the vectorcardiogram, the apparatus makes it possible also to take the usual standard electrocardiograms. In surgical practice, the vectorcardioscope is used for the continuous observation of the electrocardiogram in a patient directly during a surgical procedure.

In addition to the stationary vectorelectrocardioscope (Fig. 2) put out by Soviet industry a portable apparatus, VEKS-1p, specially designed for use in field medical installations, has been developed and put into production.

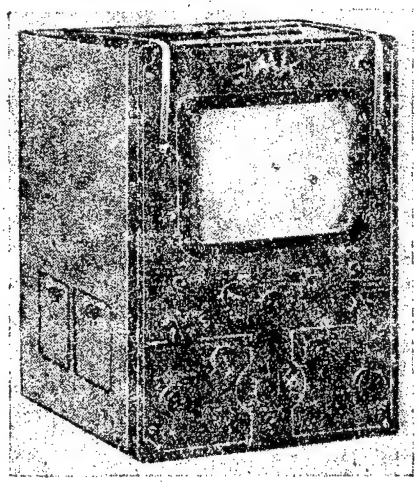


Fig. 2. Vectorelectrocardioscope VEKS

The portable VEKS-1p vectorelectrocardioscope makes it possible to carry on the investigations by the combined electrocardiographic methods (all standard leads) and of vectorcardiography (according to the methods of Akulinichev and Grishman). The apparatus operates from the alternating current power supply using a voltage of 127 and 220 volts. The effective area of the screen of the electron-beam tube is 90 x 80 millimeters; the apparatus provides for the reproduction of signals along both channels with a frequency

of from 0.2 to 400 cycles a second and a record of time with both ordinary electrocardiography and with vectorcardiography. For the purpose of graphic recording the apparatus is supplied with a photographic chamber. The dimensions of the apparatus are 400 x 200 x 200 millimeters; its weight including the appurtenances and recording parts is about 15 kilograms.

In the past year military physician I. T. Akulinichev has worked out a multichannel vectorcardioscope; he has called it a "three-dimensional oscilloscope." This apparatus makes it possible to observe three electrocardiographic leads simultaneously or three spatial projections of the vectorcardiogram or to combine records of the electrocardiogram, ballistocardiogram, sphygmogram, etc. The new diagnostic apparatus has only one electron-beam tube and a three-channel amplifier system; the recording on the tube screen is accomplished by a single beam, which is controlled through a switch by one of three amplifiers in turn, which deflect the beam on the vertical axis. The apparatus is simple to produce and use; it is somewhat less in size and weight than the stationary vectorcardioscope; it is supplied by the alternating current network.

The examination of the heart sounds gives quite a complete concept of the dynamics of cardiac activity and its disturbances. One of the oldest methods of studying the heart sounds is auscultation. The subjective nature of this method, the limited capacity of human hearing in the analysis of the temporal relationships have been the stimulus for the creation of the method of phonocardiography, that is, of an instrumental method of graphic recording of the sounds of the working heart. By supplementing auscultation phonocardiography considerably extends the diagnostic possibilities, utilizing not only hearing but also vision for the investigation of the heart sounds; the results of the examination are of a documentary nature, which affords the possibility of dynamic observation.

Special apparatuses or attachments for the ordinary electrocardiograph are used for phonocardiography. The phonocardiographic attachment FKP-1 (Fig. 3) will undoubtedly become the most widely used in clinical practice. This attachment consists of a microphone and an amplifier, has five switchable frequency characteristics and continuous control of the sensitivity; it is designed for attachment to electrocardiographs and electrocardioscopes. The attachment is supplied by a battery for a pocket flashlight; its weight is about two kilograms; its dimensions, 115 x 145 x 200 millimeters.

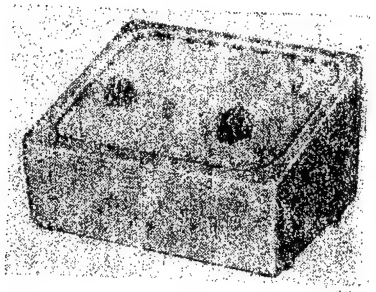


Fig. 3. Phonocardiographic Attachment FKP-1

One of the indices of the nature of activity of the cardiovascular system is the pulse frequency. At the present time, measuring devices have been created which make it possible to measure the instantaneous value of the pulse frequency or, more accurately, the time between two successive pulse waves. The pulsotachometer is a new apparatus for the prolonged continuous measurement of the pulse frequency. A photoelectric feeler is utilized in the apparatus, which is applied to the patient's finger. In clinical and physiological examinations as well as in surgical operations the apparatus makes it possible for the physician to follow the pulse frequency continuously.

The recording of the action currents of the brain is an irreplaceable diagnostic method in a whole series of central nervous system diseases as well as in various physiological investigations. The most widespread method of investigating the electrical activity of the brain is the recording of the so-called "classic" or chronological electroencephalogram. The development of radioelectronics and the possibility of creating amplifiers with a large amplification factor have made it possible to create apparatuses for the recording of the cerebral electrical potentials. The main link in the modern electroencephalograph is a low-frequency amplifier with a large amplification factor; maximum sensitivity -- one millimeter of deviation of the recorder for two microvolts of the incoming signal. A record on a moving photographic film or photographic paper is used as the recording apparatus, and for visual observation electron-beam tubes are set up in the apparatus. In the recording a curve is obtained on which the potential difference is a function of the time. Since the possibility of simultaneous recording of signals from several places is of principal importance for the precise localization of an area of pathology in the brain, these apparatuses, as a rule, have several amplification and recording channels. At the present time, the microelectrode method of investigating separate neurons of the

central nervous system is being separated out as an independent trend.

Electrogastrography is the objective method of recording the gastric motor activity during the process of digestion. During the electrogastrophic examination the alternating potentials of the gastric peristaltic activity are recorded. Until recently, the motor activity of the stomach was studied usually by tapping the action currents only from the gastric mucosa. At present, experimental models of portable electrogastrographs EGS-2 (Fig. 4) have been constructed which are supplied by an alternating current network and which satisfy the basic requirements and make it possible to record an electrogastrogram in patients directly from the surface of the body.

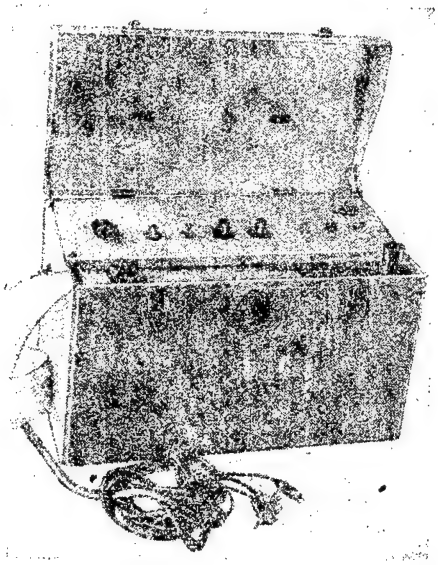


Fig. 4. Electrogastrograph EGS-2

Low-frequency pulse apparatus. The pulsating current has begun to be applied extensively at the present time for diagnostic and therapeutic purposes. Here, the duration, frequency and shape of the impulses as well as the sequence and total number of them are of essential importance.

The diagnostic method in the use of pulsating currents is based on the capacity of the tissue for being excited with the passage of an electric current through it. The degree and character of the tissue excitation depend on the strength of the current and the duration of its effect. For the diagnosis an investigation is made of the excitability threshold of the tissue, its excitability curve, etc. As a stimulus use is made of a direct current, single impulses of different durations and periodic impulses of different durations and frequencies.

For the purpose of clinical diagnosis use is made of the following apparatuses which are on mass production: the KED -- a classic diagnostic apparatus which provides for the determination of the galvanic excitability and the tetanic electroexcitability where the current impulse frequency is 100 cycles per second and the duration is one meter/second; the EI -- the electric pulsator which makes it possible to determine the main parameters of electroexcitability -- galvanic excitability, chronaxie and lability; the ISE -- pulsating electronic stimulator, which is essentially similar to the electric pulsator in its effect.

Aside from diagnosis, low-frequency pulsating currents are also used for therapeutic purposes. The electric stimulation of muscles is used for the purposes of restoring the respiratory functions of pathologically affected musculature. The stimulation is carried out with rectangular current impulses or impulses of exponential form applied to the muscle. The rhythm of application of the series of impulses should provide for an alternating contracting and relaxation of the musculature.

For therapeutic purposes use is made of the following: the ASM -- an apparatus for stimulation of injured muscles by the training method (electrogymnastics), the ESD -- an electronic stimulator of respiration (Fig. 5) for the purpose of restoration of an impaired respiratory function by means of pulsating current stimulation of the respiratory musculature and phrenic nerves.

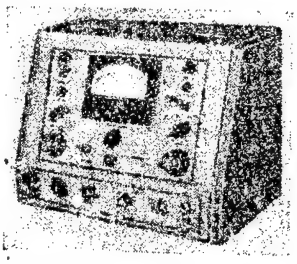


Fig. 5. Electric Stimulator of Respiration

The therapeutic apparatus differs from the diagnostic apparatus in the lesser degree of accuracy of dosage of the current parameters and the existence of additional very specific electrical characteristics, the need for which is determined by the use of the given therapeutic method.

Mention should also be made of the application of the pulsating current for affecting the cerebral cortex with the aim of obtaining a nerve cell inhibition leading to a drowsy state or sleep, which in the majority of cases continues even after the current has been turned off;

electronarcosis may be produced in a similar way. Electric sleep has already been included in clinical practice and is used in the treatment of various central nervous system diseases, while electronarcosis is still being carried out only experimentally.

High-frequency apparatus. Radioelectronic technical equipment is used most extensively in modern physiotherapy. Oscillators generating waves of any shape, from the lowest to the highest frequencies, dosimeters and other apparatus are being incorporated into the practice of Soviet medical institutions to a progressively greater extent. In physiotherapy use is made of the energy of electromagnetic waves over a broad spectrum of frequencies -- from scores of kilocycles per second to thousands of megacycles per second.

The following methods of high-frequency therapy are used for therapeutic purposes: a) d'Arsonval currents -- pulsating, strongly damped high-frequency waves (150-300 kilocycles per second); b) contact diathermy -- the use of high-frequency currents (one to 1.5 megacyvles) of comparatively low voltage (100-200 volts) and a considerable current strength (one to three A) for the purpose of heating the tissues or coagulation of them; c) inductothermy or short-wave diathermy -- the use of the effect of a high-frequency (13.5 megacycles/sec) magnetic field for therapeutic purposes; this method is safer and much more convenient than contact diathermy, and should replace it completely in the very near future; d) an electric ultra high-frequency field for the purpose of heating certain parts of the body, to which two insulated electrodes are applied; the tissues are heated to great depth; however, the greatest heat production occurs in the fatty tissues. At present, a new electrode has been worked out for the purpose of heating muscle tissue by UHF therapy; this is constituted by an oscillatory circuit extending out of the apparatus; the heating of the muscle tissue is accomplished by the eddy currents formed in it.

In recent years, microwave therapy has begun to be used (decimeter and centimeter waves) in which the energy of the electromagnetic field is directed toward the patient by means of a radiator with a reflector, the shape of which depends on the procedure being accomplished. The method provides for the preferential heating of tissues possessing dielectric permeability (tissues abundantly supplied with blood, muscle tissue), but on account of the rapid absorption of energy the depth of the heating is limited to five or six centimeters. For the purpose of microwave therapy use is made of a special magnetron which operates under conditions of continuous oscillation. The frequency of the waves amounts to 2375 megacycles.

The investigations have shown that UHF produces, in addition to the purely thermal effect in the tissues, a specific effect which is not associated with the production of heat. The strong impulse of the UHF field lowers the blood pressure and normalizes the metabolism. For the purpose of obtaining a pulsating UHF field a special apparatus has been created (Fig. 6).

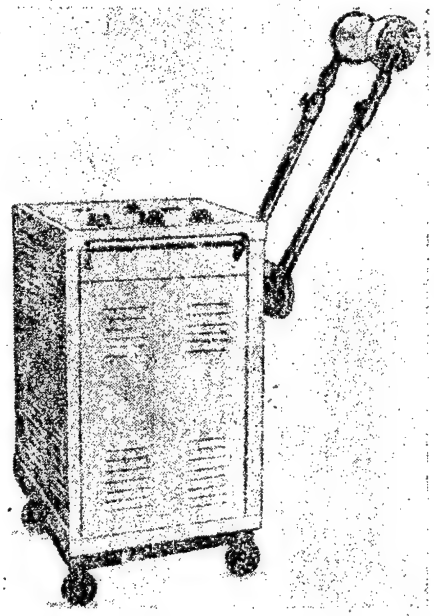


Fig. 6. Apparatus for Pulsating UHF Therapy

The apparatuses used for contact diathermy usually are all-purpose for physiotherapy and surgery. Appropriate switching and utilization of special electrodes makes these apparatuses suitable for cutting and coagulation of tissues in surgical operations (electric knives). In eye operations use is made of a portable diathermocoagulator, which represents a low-output double-cascade generator.

Ultrasonic medical apparatus. Ultrasonic waves are being used to a progressively greater extent in therapy and diagnosis. As a result of the high frequency of the waves the wave length of the ultrasound is considerably less than that of a sound wave. One of the characteristics of ultrasound is the greater intensity of its waves, which exceed the intensity of the waves in the audible range by many times. All its physico-chemical and biological effects are produced specifically by the great degree of intensity of the ultrasound. The mechanism of action of ultrasound on the living organism is complex and consists of a mechanical, physico-chemical and thermal component; apparently, a nerve-

reflex factor underlies its action.

The application of ultrasound to medicine is being developed along two lines. First of all, ultrasound serves as a medium for controlling the condition of the medium (in the given case, of tissue) in which it is being conducted. By observing the change in the velocity and absorption of the ultrasound it is possible to detect very fine physicochemical changes in the tissues being studied. Ultrasound also makes it possible to determine the homogeneity of the tissue studied and to establish the shapes and boundaries of inhomogeneous inclusions; this concept may include foreign bodies, the boundaries between two adjacent tissues, tumors, etc. Ultrasound used for these purposes does not affect the properties or normal functioning of the tissues being studied.

Characteristic of the second trend is the effect of ultrasound on various tissues or parts of them. In this case ultrasound of great intensity is used which produces the necessary physiological reaction. Of the main branches in this trend note should be made of ultrasound therapy and "surgery without a knife"; the latter is characterized by the possibility of destroying internal tissues without affecting the outer ones. The selective effect in these cases may be achieved both through the selective absorption of the ultrasound waves by different tissues and by the use of physical methods of controlling the beams of ultrasound waves (focusing).

The most widely used range in the current therapeutic ultrasound apparatuses is 800-1000 kilocycles per second. The apparatus is constituted by a tube oscillator of high-frequency waves which go into a piezoelectric converter made of quartz or titanate.

The all-purpose ultrasound apparatus, UZU-1 (Fig. 7), the experimental model of which is being tested, operates on three frequencies -- 450, 900 and 2500 kilocycles. There is an individual ultrasound head with a converter made of barium titanate for each of the frequencies. The converter is cooled by tap water. The irradiation may be accomplished continuously or with impulses having a repetition rate of 50 cycles.

Along with therapy, ultrasound is finding application for diagnostic purposes. Use is made of the reflection and absorption of ultrasound and on the relationship of these phenomena to the density, elasticity and homogeneity of tissues. Most often, the sound echo method (echo depth finder) is used for diagnosis.

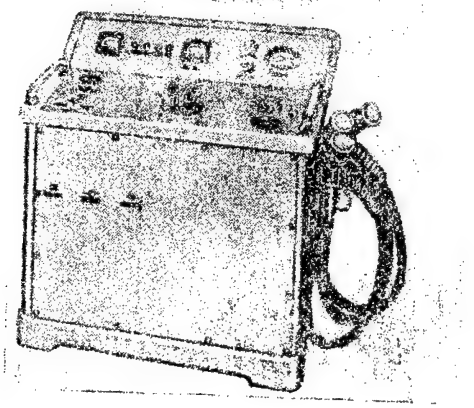


Fig. 7. All-Purpose Ultrasound Apparatus

It has now become difficult to list the various radioelectronic devices and apparatuses used in experimental and clinical medicine. However, the tremendous possibilities that electronics has for improving the quality of the apparatuses and for the complete correlation of them with modern medical requirements are not as yet being adequately used.

Radioelectronics will undoubtedly play the decisive part in the matter of creating new medical methods of prophylaxis, diagnosis and treatment of disease. Considerable and collaborative work of physicians at large and engineers is required, and the technical knowledge of medical workers should be increased steadily so that they can more fully and completely utilize radiotechnics and electronics in the service of protecting the health of the Soviet individual.

# New Surgical Cold Light Mirrors

G. V. Astaf'yev
S. F. Fedorov, Candidate of Medical Sciences

Good illumination of the operating field, which makes it possible for the surgeon to see the anatomic-topographic relations in the wound, is an obligatory condition for any operation. At the present time, there are various sources of illumination on supply in medical installations, beginning with the simplest reflectors and ending with the complex stationary apparatuses. However, any lighting device, the source of light of which is outside the operative field, cannot completely satisfy the surgeons, particularly during operations in deep wounds and cavities and in those of which the outlines are complex. In addition, all these apparatuses are unsuitable where there is no electric power supply.

Certain surgeons are using instruments (mirror, spatula, retractor, etc.) at the working end of which a small electric light bulb is set. Such a "local lighting" is convenient because the surgeon, by moving the instrument, can center the source of light in the necessary part of the wound. Despite the variety of types of such illuminating instruments produced by industry, they are not extensively used in cavity operations, because they have essential defects (contrast shadows, danger of electrothermal and mechanical injury through accidental breakage of the light bulb, etc.).

A better solution of the problem of local illumination for operations in deep wounds and cavities is the use of illuminating apparatuses which have obtained the name of cold light mirrors, the construction of which has become possible through the achievements of modern polymer chemistry (Fig. 1).

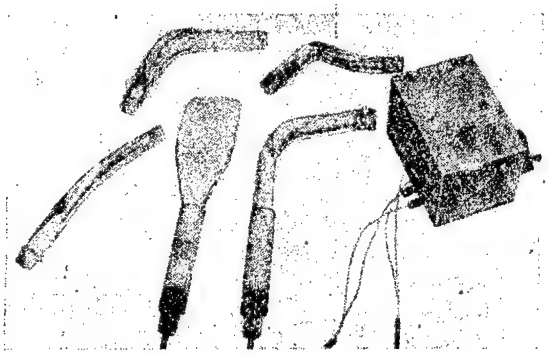


Fig. 1

The idea of the optical system of the cold-light mirrors is based on the use of phenomena of complete internal reflection of light at the borders of media with different optical permeabilities. A miniature electric light bulb is screwed into the socket of a bar. The bar with the socket and the electric light bulb are inserted into a handle and fastened with a slip-over nut (Fig. 2). During operation the beam of light from the light bulb is refracted by the spherical plane surface of a mirror, as with a lens, is subjected to complete internal reflection, passes along the bent body of the blade and is scattered at the rough surface of the terminal part of the mirror; the cold and soft light is radiated in all directions.

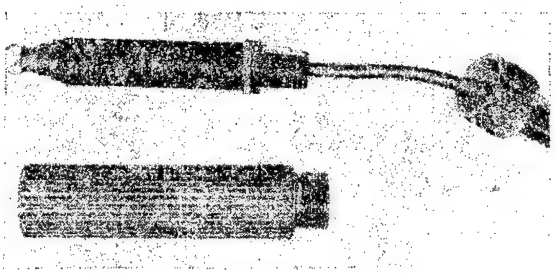


Fig. 2

As a result of work carried on at the NIIEKhAiI [Scientific Research Institute of Experimental Surgical Equipment and Instruments] heat-stable material has been found which does not deform and which does not become soft when heated to 125°; therefore, generally accepted sterilization methods are permitted for it. The blades of the mirrors are made of organic glass of the ST-1 brand; the casing of the handles and bars is made of capron. The sites of the attachment of the blades to the handles and the connection of the bars with the handle are reinforced with special polyethylene packing, which eliminates the entrance of water and the bridging of the contacts in the light bulb socket. All the places where the conductors were connected were insulated with a special silicon lac, MK-4, and the leads themselves were insulated with a polychlorvinyl covering. Therefore, the special selection of material makes it possible to sterilize these articles in the assembled form together with the conductors and to eliminate the danger of possible electric trauma from their use.

The electric feed of the light bulbs may be derived from dry cells of various types, from storage batteries, from the city network using any voltage. In the latter case, use is made of a portable transformer (see Fig. 1). Any miniature low-voltage electric light bulbs with a socle

of the R-10 type may be used in the mirrors. The transformer makes it possible to use three mirrors simultaneously, which is often necessary during operations, and to change the degree of incandescence of the filaments with a special switch. Owing to the transparency of the organic glass tissues may be seen which are compressed by the blade of the mirror; the light articles of equipment with their rounded edges traumatize the tissues less than do metal instruments.

In accordance with the desires of specialists in the NIIEKhAiI, cold-light mirrors for various purposes have been worked out, including a series of mirrors suitable for operations under military field conditions. This group includes the following: a spatula-mirror, transilluminator, mirror for the liver, for the gall bladder, for exposing the kidneys, a set for operations on the pelvic organs, chest cavity, and a luminous anoscope. The blades of the luminous mirrors correspond to metal instruments of the same type in their size and shape, but the thickness of their walls is somewhat greater than the thickness of the metal mirrors.

The new cold-light mirrors have been tried out in many medical installations of Moscow, and the most favorable reports have been received.

# Mirror-Illuminator for Operative Field

F. P. Komarovich, Lieutenant Colonel of the Medical Service

In intracavity operations, particularly on organs of the chest cavity, the rapidity and quality of the procedure depends to a great extent on the illumination of the operative field.

The existing illuminating devices do not provide adequate lighting in the depth of the wound in all cases and at times are inconvenient to use. Particular difficulties are experienced in dissecting out the elements of the lung root. We have devised a mirror-illuminator in the form of a rake, which makes it possible to displace the mediastinal organs and illuminate the lung root well simultaneously. This mirror can be utilized not only in operations on the lungs but also in other operative procedures which require illumination in the depth of the would.

The mirror-illuminator consists of a metal tube, a detachable portion of the handle which is electrically wired, a protective cover for the electric light bulb and detachable mirrors (Fig. 1). The tube, mirror and protective cover are made of stainless steel.

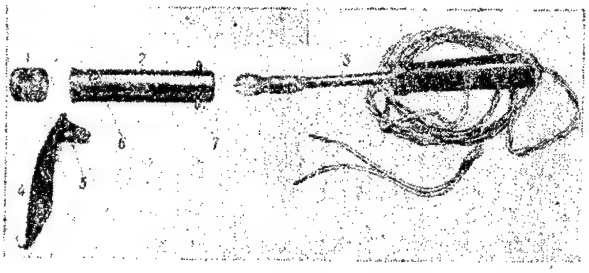


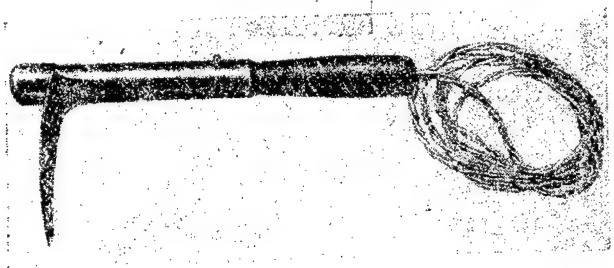
Fig. 1.

The length of the metal tube is two to 145 millimeters. The diameter of the lumen of it depends on the size of electric light bulb. We used a 6-volt light bulb on 15-21 watts with a diameter of 25 millimeters. On both ends of the tube there is an internal slot for the attachment of the protective cover and the detachable part of the handle with the electrical equipment. At the end with the screwed-in protective cover there is an obturator spindle with a mushroom head 6 for the attachment of the detachable mirrors; corresponding to this spindle a pyriform slot 5 has been cut out in the mirror 4. At the opposite end are two small cylindrical pins 7 for the attachment of a sterile fabric cover.

In the wall of the protective cover 1 opposite to

the mirror a window measuring 25 x 15 millimeters has been cut out. The light from the electric light bulb comes out only through this window, illuminates the operative wound and does not blind the surgeon. A second cover made of quartz glass has been set in themetal cover, applied tightly to the walls of the former. In order to keep the glass cover from falling out during sterilization it is attached to the metal cover with BF-2 glue.

The detachable part of the handle 3 is made of plastic. At its central end there is a metal rim with a slot for connection with the metal tube. An opening has been made inside the handle and a thin-walled metal tube with a diameter of 8 to 10 millimeters with a socket for the electric light bulb at the end is inserted into it. The electrical conductor from the socket, after passing through this tube, goes out into the peripheral end of the handle. The mirror-illuminator in its assembled form is shown in Fig. 2. The metal tube and mirror are boiled before use; the protective cover is sterilized in triple solution [?] or boiled. The detachable part of thehandle is not sterilized but rather is covered with a sterile fabric cover.

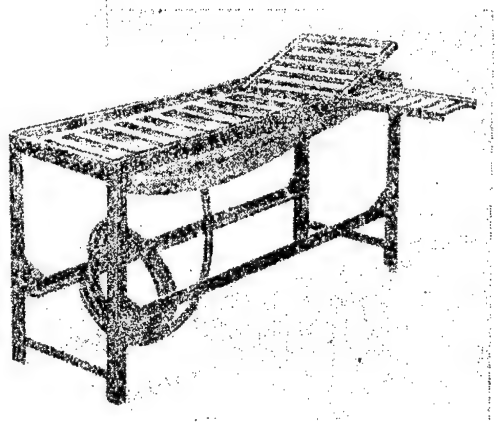


For the work the apparatus is hooked up to the power supply system through a step-down transformer or to a storage battery. In practical work the mirror is very convenient: it makes it possible to expose well and simultaneously illuminate those parts of the operative field which cannot be adequately lighted even with several light sources from different directions. The assembling of it, sterilization of it and preparation of it for operation are not difficult; making it does not require considerable expense. The detachable mirrors of different shape make it possible to use the apparatus described in various operations.

## Field Operating Table

V. I. Bezhenutsa, Captain of the Medical Service

For the purpose of surgical treatment of the wounded and burned we have prepared a table of duralumin (see Figure). Its size corresponds to the size of the standard field operating table.



The table frame has been made of corner metal which furnishes complete protection against the possible spilling of wash water; the table itself is made of duralumin strips 50 millimeters in width and three millimeters in thickness. The distance between the strips is 60 millimeters. At the head end of the table the head portion of it is attached to hinges, and this may be given the necessary elevation by means of a prop. A detachable arm-rest for the upper extremity is attached to the frame in this portion of the table by means of two slots. The legs are attached to the table by hinges. Good stability of the table is assured by detachable longitudinal strips of metal. The table is supplied with a special receptacle for wash water made of two layers of compressed oilcloth. In the middle of the receptacle there is a duralumin connecting pipe 35 millimeters in diameter which is attached by means of a nut. A rubber hose 4 meters and 50 centimeters in length is set on the connecting pieces; under field conditions it can be led out beyond the tent. The lumen of the connecting pipe is protected with a screen so that the rubber hose does not become stopped up with gauze balls.

The edges of the oilcloth receptacle are attached between plastic plates. By means of clamps attached to the plastic plates the receptacle is quickly and conveniently attached to the table frame.

The weight of the table which we are suggesting is

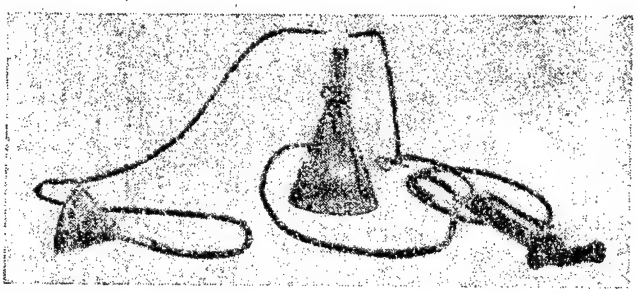
half of the weight of the field operating table adopted on supply. The table folds up and is of small size.

## Adaptation to Seitz Apparatus for Filtration of Water Samples

G. I. Gurgenov, Captain of the Medical Service
G. A. Ryzhkov, First Lieutenant of the Medical Service

We have designed a simple adaptation to the Seit apparatus which makes it possible to carry out the filtration of water samples directly at the water source, thereby eliminating the need for transportation of bottles with water to the laboratory.

As shown in the Figure, a rubber stopper with two openings is mounted on the usual cylinder of the Seitz apparatus with a Bunsen flask and L-shaped glass tubes are inserted into it. The water sample is taken out by means of a funnel connected through a thick rubber hose with one of the L-shaped glass tubes. In order to keep the air column in the rubber hose before the cylinder and in the cylinder of the Seitz apparatus itself from exerting considerable resistance in the aspiration of the water it is removed. For this purpose a second L-shaped tube is connected through a T-piece with a pump and the Bunsen flask with a rubber hose to which a Mohr clamp has been applied. During the operation of the pump all the air from the system is aspirated, passing through the filter, and the water begins to enter the cylinder freely. For the purpose of preventing the entrance of water into the pump the hose before the T-piece is immediately cut off with the clamp as soon as water appears in the second glass tube. After the filtration of the water the filter is put into a flast containing physiological solution and sent to the laboratory.



The adaptation which we have described has been used in taking water samples from the water supply system, wells and open water bodies. In the latter case a float was fastened to the rubber hose which enabled us to keep the funnel at the desired depth.

The adaptation to the Seitz apparatus is simple to use, readily disinfected and can be made without great expense in any laboratory.

## Criticism of the "Textbook on Military Medical Statistics"

(Ye. L. Notkin. Textbook on Military Medical Statistics. Published by the Military Faculty of the Institute for the Advancement of Physicians under the editorship of U. . Voloshina, Colonel of the Medical Service)

Professor Ye. Y . Bolitskaya, Colonel of the Medical Service

Generally, there is not much literature on military medical statistics, particularly in the division of textbooks, where it is actually limited to "The Guide-Book on Military Medical Statistics" by L. S. Kaminskiy (1954) and "Methods of Medical Statistics and Their Application to Ships and Naval Units" by V. D. Serebryannikov (1954). Various other texts may be named on specific problems. Therefore, the publication of the "Textbook on Military Medical Statistics" by Ye. L. Notkin should be welcomed. The textbook consists of two parts. The first part, "Fundamentals of Theory" was published in 1956 and includes the introduction and five chapters. The subject and the problems of military medical statistics are analyzed in the first chapter, and brief historical information is given there; in the second chapter the stages of statistical investigation (observation, summary, generalization and analysis of the statistical data) are discussed; in the fifth chapter the use of methods of mathematical statistics is reported in scientific medical investigations. Along with these chapters devoted to general methodological problems, the third chapter contains the methods of study of the physical condition of the troops (chiefly of the morbidity rate), and the fourth chapter, methods of study of casualties.

The second part of the textbook "Methods of nalysis of the ctivity of the Military Service" was published in 1958; it consists of two divisions pertaining to the methods of analysis of the statistical material during war and peace time. The first division consists of four chapters in accordance with an analysis of the statistical data of the medical service of the military unit, hospital, apparatuses of the medical service and data concerning the sanitary hygienic and antiepidemic care of the troops.

The second division is devoted to war time and consists of seven chapters pertaining to the an lysis of statistical material of the medical service of the military unit, division, hospital and evacuation station, of military medical boards, of apparatuses of the army and front-line medical service, data on the sanitary hygienic and

antiepidemic care of the troops and the medical coverage of the battle operation.

At the end of the book a bibliographic index is presented on medical and military medical statistics.

Even a brief list of the divisions and problems included in the text being criticized attests to its current importance and breadth. The "Textbook" has been written on the current scientific level. The author correctly treats the main principled elements of medical statistics as a social-medical science, giving statistical methods in their proper place in scientific-medical research; with good basis he separates the problems of military medical records and accounts during peace and war.

Certain defects of this text should be discussed, however, particularly since the urgent need for it permits us to assume a possible republication in which it would be desirable to eliminate these shortcomings.

The main comments amount to the following. On page 164 the concept "physical condition" is identified with the broad generalizing concept "sanitary condition" or "health of the troops", which is in contradiction to the manner in which this term is handled in the official documents and in the Encyclopedic Dictionary of Military Medicine (Vol V, page 752, 757-758).

By "physical condition" is customarily understood the comprehensive individual evaluation of the state of health of various servoce men which is made by means of the dispensary service (on pages 183-184 and 196 the author explains the concept this way too). As a result of a summation of these individual dispensary evaluations a group evaluation of the physical condition of the military group --small or large unit--may be obtained.

The term "health of the troops" or the somewhat antiquated term "sanitary condition of the troops", is more extensive and general. It is applied only for the characterization of groups on the basis of statistical criteria and includes such important elements as the discharge rate from the army or the mortality rate, and is in no way included in the concept "physical condition" (strictly speaking, it does not include the morbidity rate, because it is not equivalent in its meaning to "state of health" of the service man as determined clinically). Therefore, the concept "health" or "sanitary condition of the troops" is broader than the concept "physical condition", which is only one of the constituent elements of the former.

As early as the first part of the "Textbook" the author uses the expression "indices" in different meanings: both as generalizing analytical measures (in the sense of derived

values) on page 88, with which we can agree, and instead of the generally accepted terms "relative figures" or "statistical coefficients". However, in the second part (pages seven and nine) it is stated: "the index may be expressed both in absolute and relative figures" (in connection with work losses and numbers of sick persons), with which it is certainly difficult to agree.

In the first part of the "Textbook" the author points out justifiably that the active coefficients and interrelationship coefficients can be general or special (differentiated). However, this correct standpoint is forgotten in the second part, where the given terms are used with respect to structural, extensive coefficients in which there is no medium; we are dealing here with various series of sick or wounded persons (page 7, 79 and others). From our point of view the use of these terms, which are characteristic only of coefficients, is particularly unjustifiable with respect to average values--bed turnover, average duration of bed occupancy, treatment periods (pages 57, 78-79 and others). In addition to the methodological inacceptability of these terms in the given examples, the excessive and interminable repetition of the expressions "general and differentiated" (even in the matter of correlating dietary components with the norms on page 20-21) fatigues the reader and makes the assimilation of the material difficult.

The classification of casualties presented on pages 223-224 cannot satisfy the practical demands of the medical service in war time, because those who died from wounds and diseases or who were discharged from the army are included in the group of irreversible losses. The author's reservation that this system is suited to long periods does not save the situation, particularly since during war an analysis of losses is needed for brief periods--a month, or the term of a battle operation. Definite outcomes occur after many months at rear evacuation stages in a number of cases, and such a classification of casualties according to their outcomes, which may be utilized only for generalized work ups of the post-war period, cannot be applied to the practice of the army or navy medical service.

In the first part of the "Textbook" on page 186, 203-205 a correct presentation is given of hospital morbidity rate statistics, although the term itself seems indisputable to us, and we would have preferred "statistics of hospital morbidity" or "of hospitalized patients" to it. However, unfortunately, in the second part the author rejects his own correct standpoints (pages 19-20); he speaks of the relationship of the number of hospitalized patients to the number in the unit complement as an index of the

general hospitalization, and he gives a true index of hospitalization, that is, the ratio of hospitalized patients to those first seeking medical aid under the same heading. Subsequently, the author drops both of these important indices altogether in a corresponding list (pages 22-23), which, naturally, impoverishes the analysis.

In the second part of the "Textbook" of greatest interest is the section pertaining to the analysis of statistical material on the medical service activity in war time (according to the experience of the Second World War). Naturally, it is difficult to blame the author for what he did not present in his textbook, but a discussion of this very important section in the light of the modern problems of the military medical service, which, as is well known, have been very considerably altered, might have been expected from a book published at the end of 1958.

Even if we approach the evaluation of the material presented from the standpoint of the past war, it, from our point of view, errs through its great excesses. The author, captivated by the very positive tendency of giving a method for thorough analysis, repeatedly strays from the reality not only of the modern period but also of the 1941-1945 period. On page 154-156 indices are recommended for the regimental medical aid station which are associated with the distribution of the wounded not only with respect to the localization and nature of the wounds (which, as is well known, did not exist in the medical records of the regimental medical aid station) but even with such detail as contamination of wounds, extensive soft tissue injuries, the indices of timeliness of evacuation; the distribution of the wounded according to the quantity of blood transfused, etc. All these problems require special development of the original documents at the regimental medical aid station, which could hardly be done.

On pages 177-179 and others, excerpts from "The Experience of Soviet Medicine in the Second World War 1941-1945", that is, material worked out specially in the postwar period according to hospital case histories, are presented as criteria of the surgical work of the division medical aid station. The recommendations and examples of the author with a detailed statistical distribution of those with skull wounds by individual areas or of those with eye wounds according to the number of eye injuries, according to the branch of the service and the type of wounding weapon are fortunate, because these groups of wounded persons specifically were not at all subjected to surgical treatment at the division medical aid station but rather were sent to specialized hospitals.

In the subsequent presentation numerous examples are also encountered of the incorrect application of material to and development of the "Experience" in the practice of the medical service of the army in the field. The author should have divided these chapters of the textbook into two parts: he should first have presented a list of the main, most essential indices obtained from reports and then the supplementary problems requiring special development and intensified analysis. It would have been desirable to devote a special chapter to the material of the "Experience" and to the post-war development of the problems generally; in such a chapter the recommendations and advice of the author could have been reflected, which in themselves are of considerable methodological interest.

Of the specific comments we should like to present only one. In the first part, on page 220-222 it is correctly mentioned that in fatal outcomes it is important to designate the main diagnosis accurately rather than the mechanism of occurrence of death. However, in the second part it is recommended in several places (pages 157, 172, 201 and others) that those who die be distributed according to the direct causes of death. Without even speaking about the fact that these causes are frequently impossible to establish at the regimental medical aid station without autopsy, military physicians should not orientate themselves by this and should not stray from the correct positions taken in the first part. The direct causes of death and other supplementary problems are subjects of study of the pathologists and are reflected in their records.

At the end of the second part of the textbook an extensive and very useful bibliographic list for the reader is presented on statistics. In it, there are certain inaccuracies. Thus, for example, the author of the book "Military Medical Reports of Peace Time", A. V. Sibirskiy, is incorrectly called Simbirskiy on page 368 (likewise on page 31 in the first part); A. P. Peskova published the first Russian textbook on medical statistics in 1874, not in 1875 (page 29 in the first part); the author of the outline "War With Japan" is not I. Kozlovskiy but rather N. Kozlovskiy (page 31 in part one); on page 367, A. Antonenko should have been written instead of A. Antoshenko.

The bibliography should have been supplemented (in the section on history) by the works of Ya. A. Chistovich and the well known work on the history of the Moscow Military Hospital by A. Alekov; in the division of statistics, by G. A. Batkis', A. I. Al'tovskiy's and L. V. Shenfel'd's book, "Public Health Statistics" written in ;951; and by the two volumes of works of the Second Conference on Medical Sanitary

Consequences of the War (1948); in the section of military medical statistics, by the works of P. A. Kupriyanov, "Surgical Care During Battle Operations in Finland" (Herald of Surgery imeni Grekov 1941, No 2) and of S. S. Girgolav, T. A. Ar'yev, and S. D. Loktionov, "Material on the Study of Groups of Wounded in the B ttles at the Khalkin-Gol River" (Works of the Military Medical Academy, Volume XXIX, 1941).

As is seen from the comments presented, they apply chiefly to the clarification of terms, formulations and definitions. In everything else the "Textbook" by Ye. L. Notkin is a valuable and useful book for military physicians.

## Conference on the Problem of Adaptive Reactions and Methods of Increasing the Resistance of the Body

Docent I. F. Grekh

Throughout the past century the attention of research workers interested in the development of prophylactic and therapeutic medicine has been attracted to looking for methods and facilities by means of which it might be possible to prevent and lessen the pathologic process by means of a specific effect on the cause producing it. The chemotherapeutic preparations and a considerable number of antidotes constitute such measures, and for purposes of a specific increase in the resistance of the body with respect to a given pathogenic agent vaccinations and serum therapy, etc. are used. Recently, science has accumulated facts confirming the existence of powerful nonspecific protective mechanisms increasing the resistance in the body, not for any single disease nor for the effect of a single pathogenic agent but rather in very different cases.

The credit for explaining certain mechanisms in the nonspecific resistance or increased resistance to infection, particularly the role of the phagocytic reaction, goes to I. I. Mechnikov. However, only recently has nonspecific resistance attracted special attention.

The idea of the body as a "mosaic" organization was an assumption that by means of various methods it is possible to increase its resistance, even if nonspecifically, to many pathogenic or, in any case, to unusual effects which nevertheless had a certain similarity to one another. For example, it was believed that it was possible to increase the resistance of the body nonspecifically by various methods to the effect of various infectious-disease pathogens. However, the idea was very out of the ordinary that resistance could be connected simultaneously with an increased resistance with respect to harmful physical influences, to toxins, etc.

This idea specifically, which is closely associated with the idea of the unity of the body, was the main one at the conference held in Leningrad from 1 through 4 December 1958. The Conference was organized by the Military Medical Order of Lenin Academy imeni S. M. Kirov, by the Physiological Scientific Research Institute imeni Academician A. A. Ukhtomskiy at the Leningrad State University imeni A. A. Zhdanov, by the Institute of Cytology of the Academy of Sciences USSR and the Leningrad Society of Physiologists, Biochemists and Pharmacologists imeni I. M. Sechenov. In the work of the conference more than 500 representatives of

the various specialties participated (cytologists, cytophysiologists, physiologists, Pathophysiologists, microbiologists, pharmacologists, physiotherapists, etc.) from various cities of the country.

Scientific platforms of the greatest schools and theories were represented at the Conference--The N. Ye. Vvedenskiy-A. A. Ukhtomskiy and L. A. Orbeli Schools, the D. N. Nasonov, A. D. Speranskiy, I. R. Petrov, N. V. Lazarev, etc. The advent of new facts led to a synthesis of apparently irreconcilably different viewpoints of the various schools, for example, of the A. D. Speranskiy school, on the one hand, and the I. R. Petrov and N. V. Lazarev, on the other.

A number of speakers, chiefly representatives of the Institute of Cytology of the Academy of Sciences USSR, reported that the adaptation of cells and tissues to unfavorable influences is very often nonspecific. In other words, by "adapting" the cells and tissues to a single unfavorable influence, it is possible to increase their resistance not only to the influence applied but also to other influences. The general biological importance of this conclusion became particularly obvious after V. Ya. Aleksandrov's report (Botanical Institute imeni V. L. Komarov of the Academy of Sciences USSR). He succeeded in showing two types of increased resistance which occur in the cells. Thus, by acting on pieces of a green leaf with alcohol in a certain concentration it is possible to obtain an increased reststance of the "toughening up" type: the cells are found to be more resistant to the subsequent influence of high concentrations of alcohol, to heat or cold. However, along with this, more specific adaptive changes in the cells are also possible: a green leaf taken from underneath the snow possesses an increased resistance only to the effect of cold. Similar changes were studied in experiments on protozoans (L. K. Lozina-Lozinskiy).

B. P. Ushakov's report was of special interest; he studied the processes of cellular adaptation in muscle fibers. The study of these processes led the author to the conclusion that the mechanism of them is very complicated and consists of at least three categories of phenomena: a) reactions retarding the accumulation of chemical agents in injurious doses; b) the elaboration of substances increasing the stability of the protein structure of the cells; c) increases in protein synthesis, which leads to a substitution of the protein denatured by the stimulus by the natural protein. B. P. Ushakov does not transfer these mechanisms of adaptation to the more complicated problem of adaptation to unfavorable influences by the intact organism, but, on the

other hand, emphasizes the possibility of the existence therein of methods of the occurrence of physiologically increased resistance which are different in principle. He points out that along with such adaptations, the biological meaning of which is an adaptive change in the cells and in their protein structure, another type of adaptation is widespread in the system of the intact organism and directed at preservation of the constancy of the cells rather than toward change, which physiologists call constancy of the internal milieu or homeostasis (an idea expressed by Claude Bernard).

Several reports were devoted to the problems of occurrence and maintenance of an increased physiological resistance of the bodies of higher animals and man. Thus, L. L. Vasil'yev discussed the relationship between the problems of functional resistance and adaptation, on the one hand, and the theory of parabiosis, on the other. I. R. Petrov, using reasoning derived from the research of his students, also showed that, for example, an organism adapted to a low temperature of the environment possesses an increased resistance to anoxia of various origins also; animals trained under conditions of reduced barometric pressure possess an increased resistance to both the effect of the rarified atmosphere and to hypothermia.

Considerable attention was given to mechanisms of nonspecific (interrelated) adaptive reactions. I. R. Petrov indicated the significance of the central nervous system. In the opinion of Z. I. Barbashova (Institute of Evolutionary Physiology imeni I. M. Sechenov of the Academy of Sciences USSR), an essential part in the change of the body's resistance to unfavorable influences is played by the sympathetic nervous system with its adaptive-trophic function. This effect is realized through the splanchnic nerves and abdominal sympathetic chain. The author illustrated this conclusion by the fact that the capacity of adapting to anoxia and of acquiring a generally increased resistance is maintained by rats even after complete denervation of the suprarenals as well as after the removal of the medullary layer and injury to the cortical layer. However, these experiments encountered certain methodological objects on the part of B. I. Kadykov.

The main idea of N. V. Lazarev's report was that similar changes in the body leading to a greater resistance of it to the effect of various (although not all) unfavorable environmental factors can be brought about by two different methods: by means of prolonged repeated effects of noxious agents, for example, anesthetic agents, and by means of the introducing of certain drugs into the body, which is much quicker. The speaker expressed the idea that under the in-

fluence of such agents a stimulation occurs of the protective mechanisms which are only gradually activated through more or less prolonged influences of unfavorable environmental factors. From this point of view one may think of the similarity, and perhaps also of the identity of the phenomena which occur, on the one hand, after "toughening", "training", "habituation" to unfavorable existential conditions, and, on the other, from the effect on the body of pharmacological agents which increase its resistance. In many investigations dibasol /hydrochloride of a complex heterocyclic compound with benzene radical: spasmolytic and hypotensive/ was used as the preparation for increasing the resistance. However, according to the conclusion of many speakers, other drugs possess a similar effect: ginseng (I. I. Berkhman, Khon Gen Y and others), vitamin $B_{12}$, preparations from the aralia plant family (to which ginseng also belongs).

In several reports mention was made of the unusual variety of the unfavorable influences to which it is possible to increase the body's resistance by means of drugs. N. T. Fedorov and L. N. Aleksandrov were able to increase artillerists' tolerance considerably to the effect of the shock wave by means of the use of dibasol and synthazol, a related benzimidazole derivative, which is of particular interest to the military physician. Through the injection of dibasol and certain other substances it is possible to accelerate the recovery of a number of body functions after rotation of mice in a centrifuge, and increase the resistance of rabbits to orthostatic collapse, shock-producing influences (S. M. Vishnyakov, Ye. G. Vodokhlebova), electrical trauma (S. M. Vishnyakov), anoxemias of various origins, etc. In certain reports the possibility was discussed of increasing the resist nce of the body to the effect of various toxins by means of preliminary injections of dibasol.

Many speakers expressed the opinion that drugs which nonspecifically increase the body's resistance can increase the resistance also to bacterial or virus infections. According to A. M. Kapitanenko's statement, it is possible to reduce the influenza and seasonal catarrh of the upper respiratory tract morbidity rates by means of prescribing dibasol.

The idea of the possibility of utilizing drugs which nonspecifically increase the resistance of the body for the prophylaxis of infectious diseases along with specific agents evoked vigorous objections at the conference from A. A. Sinitskiy. A lively discussion arose in which many of the participants of the conference participated. Particularly convincing arguments on behalf of the fact that the newly

discovered possibilities cannot be neglected were presented by L. G. Perets, who gave an interesting report on the nonspecific changes in the resistance of microbes to various influences when they acquire drug resistance.

Material was contained in a number of reports on the analysis of the mechanism of increase of the body's resistance through the preliminary injection of drugs. M. A. Rozin showed that the increase in resistance, particularly by means of dibasol, is effected through the central nervous system, and then through the hypophysis, suprarenals and sex glands. Certain speakers shared their data concerning the mechanism of increase in the resistance to infections. From these reports it follows that from the repeated effects of vitamin $B_{12}$ and dibasol up to the time of infection of the animals both the phagocytic activity of the leukocytes and their capacity of elaborating antibodies are increased (A. M. Kapitanenko observed the latter on people as well).

A study of the nonspecific adaptive reactions of the body gives us sufficient grounds for attempts at the practical utilization of these reactions, particularly by means of stimulation of them by certain drugs.

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## New Books

Flekel' I. M. Peptic Ulcer. Second edition, revised and supplemented. Leningrad (Medgiz). 1958, 420 pages. Price 17 rubles 50 kopecks.

The book consists of two parts; in the first of them, which is devoted to uncomplicated peptic ulcer, a brief review of the evolution of the study of peptic ulcer is presented with data concerning its distribution; the etiology and pathogenesis are described, the pathology, the clinical aspects, diagnosis, prophylaxis and treatment of uncomplicated peptic ulcer. In the second part of the book a report is given concerning the clinical aspects, diagnosis and treatment of peptic ulcer complications (hemorrhages, perforation, pyloric stenosis, development of carcinoma from gastric ulcer). The last two chapters in the book are devoted to diseases developing in operated patients and the medical board evaluation of the capacity to work and the arrangement of work in patients with peptic ulcer.

Gevorkyan I. Kh. Intraarterial Application of Drugs in Surgery. Moscow (Medgiz). 1958, 95 pages. Price 2 rubles 25 kopecks. (Library of the Practicing Physician).

Data in the literature and many years of experimental research and clinical observations on the use of drugs by the intraarterial route have been made the basis of this book. After a review of the literature the changes are described which occur in the body after the administration of drugs intraarterially, the method of this injection and the indications for it. In the last two chapters an analysis is made of the morphological changes in the arterial wall after the injection of drugs into its lumen, and the complications which occur from the injection and contraindications to it. A large bibliography of the Soviet and main foreign literature is presented in the book.

Vitamins. Vitamin Therapy and Vitamin Prophylaxis. Leningrad. 1958. 214 pages. Price 9 rubles 80 kopecks. (Works of the Leningrad Sanitary-Hygienic Medical Institute. Volume 50).

A collection of articles devoted to the study of the mechanism of action of vitamins in various pathological conditions, chiefly in the acute and chronic liver diseases. Content: S. M. Ryss--Certain Basic Problems in Modern Clinical Vitaminology; Z. G. Bezkorovaynaya--Comparative Evaluation of the Effect of Water-Soluble Vitamins on the Functional State of the Liver; T. N. Zabelina--Metabolism of Riboflavin in Botkin's Disease; Ye. V. Bogdanova--Metabolism of Pyridoxin in Acute Radiation Sickness; S. M. Tevelev--

The Role of Pyridoxin in the Prophylaxis of Certain Liver Afflictions; V. I. Petrovskiy--The Effect of Vitamin $B_{12}$ on the Principal Liver Functions and Its Significance in the Therapy of Chronic Hepatitides and Liver Cirrhoses; N. P. Karlova--The Metabolism of Vitamin $B_1$ in Peptic Ulcer; B. M. Eydel'man--Clinical Observations on the Use of Vitamin P (Citrin) in Glaucoma, and a number of other articles.

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# NEW BOOKS -- MILITARY PHYSICIANS IN WORLD WAR II IN THE WORKS OF SOVIET LITERATURE
[A Translation]

Voyenno-Meditsinskiy Zhurnal
[Military Medical Journal],
No 5, Moscow, May 1959, p 96

GERMAN, Yu. P. "Lt. Col. of Medical Service," Leningrad, Sovetskiy Pisatel' [Soviet Writer], 1956, 210 pp with illustrations.

A novel devoted to the patriotic work of medical workers during World War II. The hero of the novel is Lt. Col. Levin, a talented doctor and researcher, exacting in regard to both himself and other people. The psychology of this true Soviet patriot, who is aware of his fatal illness but has found the strength to remain at his post to the end and has overcome the fear of death, is deeply revealed.

NIKIFOROVA, A. A. "This Must Not Happen Again." Memoirs with preface by Marie-Calude Vaillant-Couturier, Military Publishing House, 1958, 149 pp with portraits.

Memoirs of Soviet physician A. A. Nikiforova, who spent three and a half years in hitlerite captivity, more than a year of them in Ravensbruek concentration camp -- a document of vast indictment force.

The author tells of the terrible fate of the women prisoners of Ravenbruek, who were worn out by overtaxing labor and died of hunger and cold, and of the tens of thousands of Polish, Czech, German, French, Dutch, Jewish and Yugoslav women who perished in the gas chambers and crematoria. Nikiforova speaks of the powerful feeling of international solidarity and identity which united the women of the various nationalities and of the aid rendered the women prisoners of Ravensbruek by the German communists, who were, themselves, exhausted after 10-12 years in prisons and camps.

DZHIGURDA, O. "Motorship 'Kakhetiya'," Memoirs of a military doctor. Leningrad. Sovetskiy Pisatel', 1948, 261 pp.

Ol'ga Dzhigurda tells of the heroic daily activities of a transport converted into a hospital ship which made a trip in war time between Sevastopol' and Tuapse, delivering troops and supplies to Sevastopol' and removing wounded from there for transport to hospitals in the rear.

KOROVIN, A. "Salute on the Neva." Memoirs of a navy doctor. Leningrad. Sovetskiy Pisatel', 1950, 412 pp.

The author, who was chief surgeon of a naval hospital on the Khanko peninsula, tells simply and frankly of the many events of World War II to which he was a witness and a participant. The reader learns of the life and work of the hospital staff on Khanko and of the deeds of the valiant defenders of the invincible Soviet Gangut .

PANOVA, Vera. "Fellow Passengers." A novel. Leningrad, Sovetskiy Pisatel', 1955, 254 pp.

A novel dedicated to ordinary Soviet citizens and inconspicuous World War II heroes -- the workers on a military medical train. The heroes of the novel are Commissar Danilov, who became the spirit of the staff, the commander of the train, Dr. Belov, a courageous man devoted to his work, senior nurse Yuliya Dmitrizevna, a person of inspired labor, and a young energetic medical attendant Lena Ogorodnikova. Each of them has his own personal life, but they are all fused together by the common cause into a friendly, self-sacrificing collective.

GILLER, V. Ye. "For the Sake of Life." Memoirs of a military doctor. Moscow, Military Publishing House, 1956, 383 pp with illustrations.

The author, the former commander of a screening-evacuation hospital, tells of his memoirs of the heroic deeds of medical workers during World War II. With great ardor and pride he speaks of his comrades: Commisar of the hospital G. T. Savinov, physicians N. I. Minin and Valya Murav'yeva, surgical nurse Katya Garanova, and others, who devoted all their skills and efforts for the sake of the lives of the fighting

men and officers of the glorious Soviet Army! The author writes with admiration of the eminent scientist and chief surgeon of the Soviet Army, N. N. Burdenko.

END

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